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96TH CONGRESS } HOUSE OF REPRESENTATIVES { REPT. 96-967
2d Session } { PART III

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AUTHORIZING APPROPRIATIONS FOR THE DEPARTMENT OF ENERGY (DOE) FOR FISCAL YEAR 1981

REPORT

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

together with

ADDITIONAL AND DISSENTING VIEWS

[To accompany H.R. 6627]

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MAY 16, 1980.—Ordered to be printed

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AUTHORIZING APPROPRIATIONS FOR THE DEPARTMENT OF ENERGY (DOE) FOR FISCAL YEAR 1981

MAY 16, 1980.—Ordered to be printed

Mr. FUQUA, from the Committee on Science and Technology, submitted the following

REPORT

together with

ADDITIONAL AND DISSENTING VIEWS

[To accompany H.R. 6627 which on February 26, 1980, was divided and referred as follows: Title I to the Committee on Science and Technology; Titles II and III to the Committee on Interstate and Foreign Commerce; Title IV to the Committee on Interior and Insular Affairs; Title V concurrently to the Committees on Interior and Insular Affairs and Interstate and Foreign Commerce; Title VI concurrently to the Committees on Interstate and Foreign Commerce and Science and Technology; Titles VII and VIII concurrently to the Committees on Foreign Affairs, Interior and Insular Affairs, Interstate and Foreign Commerce, and Science and Technology.]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science and Technology, to whom was referred title I, VI, VII and VIII of the bill (H.R. 6627), to authorize appropriations to the Department of Energy for civilian programs for fiscal year 1981 and fiscal year 1982, and for other purposes, for consideration of such provisions as fall within the jurisdiction of this committee pursuant to rule X, clause (1)(2) of the rules of the House of Representatives, having considered the same, reports favorably thereon, with amendments, and recommends that the bill as amended do pass.

AMENDMENTS

The amendments are as follows (page and line reference are to introduced bill):

Strike out title I (beginning on p. 2, line 3 and ending on p. 15, line 14) and insert the following substitute text:

TITLE I—RESEARCH AND DEVELOPMENT

SEC. 101. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following fossil energy coal programs:

(A) Mining research and development, $41,000,000.

(B) Coal preparation research and development, $10,000,000.

(C) Coal liquefaction, $161,200,000.

(D) Surface coal gasification, $75,000,000.

(E) In situ coal gasification, $9,900,000.

(F) Advanced research and technology development, $56,261,000.

(G) Advanced environmental control technology, $37,000,000.

(H) Heat engines and heat recovery, $45,900,000.

(I) Combustion systems, $30,565,000.

(J) Fuel cells, $37,000,000.

(K) Magnetohydrodynamics, $71,500,000.

(L) Program Direction, $12,145,000.

SEC. 102. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following fossil energy oil and gas programs:

(A) Enhanced oil recovery, $23,800,000.

(B) Oil shale, $35,048,000.

(C) Drilling and offshore technology, $2,000,000.

(D) Advanced process technology, $4,500,000.

(E) Enhanced gas recovery, $30,048,000.

(F) Program Direction, $1,213,000.

SEC. 103. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following conservation programs:

(A) Buildings and community systems, $75,640,000.

(B) Industrial energy conservation, $92,300,000.

(C) Transportation $110,800,000.

(D) Multisector, $15,400,000.

(E) Program Direction, $16,220,000.

SEC. 104. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following solar technology programs:

(A) Solar thermal, $110,550,000.

(B) Photovoltaics, $142,000,000.

(C) Wind, $78,900,000.

(D) Ocean systems, $44,300,000.

(E) Solar International, $23,000,000.

(F) Program Direction, $4,000.000.

SEC. 105. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following biomass energy systems programs:

(A) Systems development, $64,500,000.

(B) Market Test and Commercial Applications, $55,000,000 including $15,000,000 for FPUP.

(C) Hybrid Buildings Program, $13,015,000.

(D) Program Direction, $2,786,000.

SEC. 106. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following biomass energy systems programs:

(A) Biomass research and development, $47,650,000, of which up to $3,000,000 shall be used to prepare a comprehensive multi-year technical and management plan by March 1, 1981.

(B) Alcohol fuels, research, development, and demonstration, $17,100,000.

SEC. 107. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following nuclear fission energy programs:

(A) Converter reactor systems:

(1) Thermal reactor technology, including the following amounts for—

(a) High temperature gas-cooled reactors, $46,500,000;

(b) Light water reactor technology, $40,000,000;

(c) LWR fuel cycle R. & D.:

(i) Refabrication, $7,000,000;

(ii) Barnwell nuclear fuel plant, $9,000,000; and

(d) HTGR thorium recycle R. & D., $3,500,000.

(2) Advanced reactor systems, $2,800,000.

(3) Three Mile Island, $7,500,000.

(B) Civilian Waste Management—

(1) Operating expenses, including the following amounts for:

(a) Site exploration and investigation activities in subparagraph 107(B)(3)(a) and 107(B)(3)(b), $78,400,000.

(b) West Valley demonstration pursuant to subparagraph (B)(7)(b), $5,000,000.

(c) Waste technology and canister development activities in subparagraph 107(B)(3)(c), not less than, $9,000,000.

(d) Low Level Waste, not less than, $2,000,000.

(e) Other programs, not more than $82,589,000.

(2) No funds appropriated pursuant to any authorization in this Title may be used for the Waste Isolation Pilot Plant project, Project No. 77–13–F, near Carlsbad, New Mexico.

(3) The Secretary shall, not later than 60 days after the date of enactment of this act, establish a research, development, and demonstration program for high-level radioactive waste (hereinafter called waste) disposal to include integrated technology demonstrations to develop the necessary data and information for full-scale repositories, and to confirm the existence of technological solutions for safety disposing of high-level radioactive wastes. To implement the program, the Secretary shall:

(a) Identify four regionally distributed repository sites in the Continental United States at least one of which shall be located in each of the eastern, central, and western regions of the United States. At each site excavate to provide shafts for site characterization, suitable for further development into demonstration repositories. Such sites shall be suitable for future full-scale repositories. For purposes of minimizing delays in this program, emphasis shall be given to Federally-owned sites, including, but not limited to, sites where waste has been stored or deposited. Sites considered shall include, but not be limited to, the following geologic media: basalt, tuff, granite, and salt. Site selection shall be based upon the principle that the wastes shall be isolated from the biosphere by engineered barriers, developed pursuant to subparagraph 107(B)(3)(c), with subsequent isolation by geologic containment. The locations of the first two sites shall be identified not later than the end of the first quarter of fiscal year 1981 and the third and fourth sites by the end of fiscal year 1983. None of the activities in this subparagraph including the excavation for shafts shall be considered to be a major Federal action pursuant to subsection 102(c) of the National Environmental Policy Act of 1969.

(b) Design, construct, and operate four technology-demonstration repository facilities (herein referred to as demonstration repositories) for research and development purposes at the sites selected on the basis of the site characterization above. The demonstration repositories shall be in operation by the end of Fiscal Years 1986 for the first and 1987 for the second, with operation of the third and fourth anticipated by the end of Fiscal Year 1990. Such demonstration repositories shall be mined at depths and constructed with methods suitable for development into full-scale repositories, and they shall be no larger than is appropriate to conduct the necessary research and development activities to demonstrate the safe disposal of wastes, taking into consideration the necessary handling, engineering, space, configurations, and heat dissipation of such wastes. Each repository shall be designed with a capacity for receiving a minimum of 40 full-size canisters of vitrified waste produced pursuant to subparagraph 107 (B)(1)(c). These 40 canisters shall be designed such that the maximum surface temperature of the overpack canister is in the range 90° to 100° centigrade when emplaced in demonstration repositories. All such waste stored in any demonstration repository authorized by this Act shall be fully retrievable. The operation of the demonstration repositories shall terminate by the year 2000. The demonstration repositories shall contain wastes owned or acquired by the Federal government and primarily resulting from unlicensed activities.

(c) Design, construct and operate technology-demonstration facilities to solidify wastes by any suitable technique, including, but not limited to, vitrification. Canisters of solidified wastes shall be contained in engineered barriers which shall include, but not be limited to, overpack canisters. Such barriers shall be designed to prevent the movement of radionuclides out of the container for the time needed for the health hazard of such wastes to become comparable to the health hazard of the uranium ore mined to generate such wastes. Canisters of solidified waste shall be prototypical of that suitable for permanent placement in a full-scale repository and shall be ready for placement in the demonstration repositories at the designated time of completion of each demonstration repository. The waste at West Valley, New York may be utilized for all purposes in this subsection 107(B).

(d) As soon as is practicable, and on a continuing basis, consult and coordinate with the appropriate State officials regarding the Department's plans for, and construction of, the technology demonstration repositories which are planned to be sited in each State.

(4) Consistent with existing law, all demonstration facilities authorized in paragraph 107 (B) (3) shall be constructed and operated as non-licensed research, development and demonstration facilities.

(5) The Secretary shall utilize all funds appropriated pursuant to this title and Title VII of this Act for purposes consistent with the expeditious completion of each authorized activity, and shall not provide funds, either directly or indirectly, to any person (as defined by paragraph 11 (s) of the Atomic Energy Act of 1954, as amended), advocating a position on such activity.

(6) The Secretary shall—

(a) conduct research, development and demonstration on advanced techniques for disposing of low-level radioactive wastes;

(b) conduct a study which shall include an analysis of the advantages and disadvantages of (i) using a glass furnace, or other appropriate device, to consume and reduce the volume of low-level wastes while at the same time appriately containing such wastes; (ii) locating any such volume reduction and solidification facility at nuclear power plants to serve as regional processing facilities prior to shipment for final disposal of all low-level wastes generated in the region; (iii) using existing underground caverns produced by nuclear explosive detonations for disposing of low-level wastes; and (iv) allowing short-lived, low-level wastes to be held in storage until safe for disposal as non-radioactive wastes.

(c) submit a report by February 1, 1981 containing the findings, conclusions, and recommendations resulting from the study required by subparagraph 107 (B) (6) (b) to the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate.

(7) (a) (i) The Secretary of Energy (hereinafter in this section referred to as "Secretary") shall carry out, in accordance with the provisions of this section, a high-level liquid nuclear waste management demonstration project at the Western New York Service Center in West Valley, New York (hereinafter referred to in subsection (B), paragraph (7)

as "the project"). The Secretary shall carry out the project by vitrifying the high-level liquid nuclear wastes located at such center or by employing the most effective technology for solidification available. The Secretary shall, as part of the project, also (A) as soon as feasible transport such solidified wastes, in accordance with applicable provisions of law, to an appropriate Federal repository for long-term burial, and (B) decontaminate and decommission facilities, materials, and hardware used in connection with the project.

(ii) During the fiscal year ending September 30, 1981, the Secretary shall—

(A) prepare a plan for safe removal of such wastes from tank numbered 8D-2 and any other storage tank at the Center containing such wastes, including safely breaching the tanks, operating waste removal equipment, and sluicing techniques, and

(B) determine the feasibility of immobilization and waste handling techniques required by the unique situation of such wastes at the Center, including initiation of detailed engineering and cost estimates as well as safety analyses and environmental impact analyses.

(iii) Title to the high-level liquid wastes at the Center shall be transferred to the United States upon payment by the State of New York and other appropriate persons of an appropriate fee, as determined by the Secretary, for the perpetual care and maintenance of such wastes.

(b) There is authorized to be appropriated to the Secretary not more than $5,000,000 for the fiscal year ending September 30, 1981 for the project. Funds authorized and appropriated in subsequent fiscal years for the project shall not be used by the Secretary for such purpose until the Secretary, the State of New York, and other appropriate persons enter into such contracts and agreements as may be required—

(i) to provide for the transfer of title of such wastes and the payment therefor,

(ii) to enable the Secretary to utilize property and facilities at the Center for the project,

(iii) to share the costs of the project, except that the non-Federal share of such costs shall be limited to no more than 10 per centum thereof and in determining such share the Secretary shall consider the utilization of such center by the Secretary for the project, the amount of money in the existing perpetual care fund originally designated to provide for ultimate disposition of the high-level liquid nuclear waste at the center, and such other factors as the Secretary deems appropriate, and

(iv) to otherwise provide for the conduct of the project in a timely manner.

(c) In carrying out the project, the Secretary shall consult with the Nuclear Regulatory Commission, the Administrator of the Environmental Protection Agency, the Secretary of Transportation, the Director of the Geological Survey, the State of New York, and the commercial operator of the Center.

(d) Not later than February 1, 1981, and on February 1 of each calendar year thereafter during the term of the project, the Secretary shall transmit to the Committee on Science and Technology, the Committee on Interior and Insular Affairs, and the Committee on Interstate and Foreign Commerce of the House of Representatives and the Committee on Energy and Natural Resources of the Senate an up-to-date report containing a detailed description of the activities of the Secretary in carrying out the project, including the costs incurred, and the activities to be taken in the next fiscal year and the costs thereof. Any contract or agreement executed under subsection (b) of this section, together with summaries thereof, shall be promptly transmitted to such committees for their information and review.

(e) Other than the costs and responsibilities established by this section for the project, nothing in such section shall be construed as affecting any rights, obligations, or liabilities of the commercial operator of the Center, the State of New York, or any person, as is appropriate, arising under the Atomic Energy Act of 1954, as amended, or under any other law, contract, or agreement for the operation, maintenance, or decontamination of any facilities or property at the Center or for any wastes at the Center. Nothing in such section shall be construed as affecting any applicable licensing requirements of the Atomic Energy Act of 1954, as amended, or the Energy Reorganization Act of 1974, as amended. The provisions of this section shall not apply or be extended to any facility or property at the Center which is not used in conducting the project.

(8) (a) (i) The Secretary shall conduct a study of the fiscal impact of activities carried out in conjunction with the West Valley project as authorized in paragraph (7) and make recommendations to the Congress (taking into account, among other things, criteria of the type specified in section 91 of the Atomic Energy Community Act of 1955, as amended) concerning the payment of just and

reasonable sums to the town of Ashford and West Valley Central School District in the State of New York during the conduct of such project. Not later than February 1, 1981, the Secretary shall submit to the appropriate committees of the Congress a report containing the findings, conclusions, and recommendations resulting from such study.

(C) Spent fuel storage research and development—operating expenses, $6,500,000.

(D) Advanced nuclear systems:

(1) Advanced systems evaluation, $3,000,000.

(2) Space and terrestrial applications, $35,200,000.

(E) Breeder reactor systems:

(1) Liquid metal fast breeder reactor plant projects:

(a) Fast flux test facility, $76,000,000;

(b) Clinch River breeder reactor project and joint plant design activity, $155,000,000, of which up to $15,000,000 is authorized to be appropriated for a joint plant design activity under the LMFBR Bilateral Energy R. & D. Agreement of September 20, 1976, with the United Kingdom; and

(c) Breeder reactor studies, $7,500,000.

(2) Liquid metal fast breeder reactor technology, $142,989,000.

(3) Liquid metal fast breeder reactor test facilities, $81,000,000.

(4) Water cooled breeder reactor:

(a) Shippingport atomic power, $11,000,000.

(b) Light water breeder reactor, $24,000,000.

(c) Advanced water breeder applications, $5,000,000.

(d) Proof of breeding, $2,600,000.

(5) Fuel cycle research and development, reprocessing, $18,000,000.

(F) National uranium resource assessment research and development, $6,000,000.

(G) Program direction, $15,902,000.

SEC. 108. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following nuclear fusion programs:

(A) Magnetic fusion:

(1) Confinement systems, $100,600,000.

(2) Development and technology, $70,600,000.

(3) Applied plasma physics, $65,800,000.

(4) Reactor projects $58,000,000.

(B) Program direction, $3,300,000.

(C) Policy directive.

The objectives of the magnetic fusion energy research, development, and demonstration program shall be—

(1) to proceed immediately with all work necessary to construct and operate a fusion engineering test facility by calendar year 1987;

(2) to follow the operation of the fusion engineering test facility with all steps necessary to construct and successfully operate a magnetic fusion demonstration facility before the end of this century;

(3) to maintain, and where appropriate expand, the base programs for fusion energy research, and the development and testing of appropriate alternative confinement technologies;

(4) to maintain a strong research and development program in advanced fusion fuels; and

(5) to take appropriate measures to ensure the maintenance of an uninterrupted source of scientific and engineering talent from the Nation's colleges and universities in support of the magnetic fusion energy effort.

(D) Program directive.

(1) The Secretary is directed to establish immediately and carry forth such research, development, and demonstration programs, projects, or activities as may be necessary to meet the objectives as set forth above. As a part of any such program, project, or activity, the Secretary shall—

(a) conduct and promote the coordination and acceleration of research, development, and demonstration programs relating to magnetic fusion energy systems and components thereof;

(b) seek support from and encourage cooperative efforts with the United States private sector and with other governments in carrying out the purposes set forth above;

(c) study the potential of using fusion energy systems for the production of hydrogen and other synthetic fuels, and for other nonelectric applications; and

(d) investigate the potential of using fusion power for the electrification of all or part of domestic ground transportation systems.

(2) The Secretary shall take all possible steps to assure that full and complete information with respect to the potential benefits of fusion energy, and the status and progress of fusion research, development, and demonstration is made available to Federal, State, and local authorities, relevant segments of the economy, the scientific and technical community, and the public at large with the objective of promoting and facilitating to the maximum extent feasible the early and widespread knowledge of the practical uses of fusion energy throughout the United States.

(E) Inertial confinement fusion (civilian applications), $7,500,000.

SEC. 109. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following geothermal energy programs:

(A) Hydrothermal energy, $40,613,000.

(B) Geopressured resources, $35,800,000.

(C) Geothermal technology development, $41,890,000.

(D) Geothermal Resources Development Fund, $1,091,000.

(E) Program direction, $2,569,000.

SEC. 110. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following low head hydroelectric program:

(A) Small-scale hydropower resource development, $6,211,000.

(B) Program direction, $789,000.

SEC. 111. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following supporting research programs:

(A) Power supply integration, $19,000,000.

(B) Power delivery, $18,500,000.

(C) Program direction, $923,000.

SEC. 112. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following energy storage systems programs:

(A) Battery storage, $37,800,000.

(B) Thermal and mechanical storage, $36,300,000.

(C) Program direction, $1,000,000.

SEC. 113. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following basic energy sciences programs:

(A) Nuclear sciences. $32.400,000.

(B) Materials sciences, $89,400,000.

(C) Chemical sciences, $60,200,000.

(D) Engineering, mathematical, and geosciences, $26.100,000.

(E) Advanced energy projects, $7.100,000.

(F) Biological energy research, $8,200,000.

(G) Program direction. $2.444.000.

SEC. 114. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following supporting research programs:

(A) Technical assessments projects. $17.200,000.

(B) University research support. $7.500,000.

(C) Engineering traineeship program. $5,000,000.

(D) Technical program and policy analysis. $1.981,000.

(E) Program direction, $860,000.

SEC. 115. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following high energy physics programs:

(A) Physics research, $76,500,000.
(B) Facilities operations, $112,300,000.
(C) High energy technology, $48,580,000.
(D) Program direction, $865,000.

SEC. 116. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following nuclear physics programs:

(A) Medium energy nuclear physics, $45,555,000.
(B) Heavy ion nuclear physics, $35,975,000.
(C) Nuclear theory, $7,000,000.
(D) Program direction, $270,000.

SEC. 117. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the uranium enrichment process development program, as follows:

(A) Uranium enrichment process development operating expenses, $78,500,000.

(B) Advanced isotope separation technology, $73,299,000, including $944,000 for program direction.

SEC. 118. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following environmental research and development programs:

(A) Overview and assessment, $51,770,000.
(B) Environmental research, $158,151,000.
(C) Life sciences research, $42,650,000.
(D) Program Direction, $11,133,000.

SEC. 119. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for capital equipment expenses not related to construction for the following energy programs:

(A) Fossil:
    (1) Coal, $4,600,000.
    (2) Oil and gas, $2,970,000.
(B) Conservation:
    (1) Building and community systems, $950,000.
    (2) Industrial energy conservation, $1,000,000.
    (3) Transportation, $1,500,000.
(C) Solar Applications, $2,500,000.
(D) Solar, Technology:
    (1) Solar Thermal, $3,500,000.
    (2) Photovoltaics, $7,000,000.
    (3) Wind, $2,100,000.

(4) Ocean Systems, $700,000.

(E) Biomass, $750,000.

(F) Nuclear fission:

(1) Converter reactor system, $2,200,000.

(2) Civilian waste management, $11,610,000.

(3) Spent fuel, $1,000,000.

(4) Advanced nuclear systems, $2,800,000.

(5) Breeder reactor systems:

(a) Liquid metal fast breeder reactor, $15,700,000.

(b) Water cooled breeder reactor, $1,600,000.

(c) Fuel cycle research and development, $3,000,000.

(G) Nuclear fusion:

(1) Magnetic fusion:

(a) Confinement systems, $20,300,000.

(b) Development and technology, $10,200,000.

(c) Applied plasma physics, $6,700,000.

(d) Reactor projects, $5,900,000.

(H) Geothermal, $1,310,000.

(I) Electric energy systems, $1,500,000.

(J) Energy storage systems, $1,700,000.

(K) Basic energy sciences programs, $15,500,000.

(L) High energy physics, $37,000,000.

(M) Nuclear physics, $9,400,000.

(N) Uranium enrichment process development:

(1) Process development, $3,300,000.

(2) Advanced isotope separation technology, $9,000,000.

(O) Environmental research and development programs, $16,640,000.

Sec. 120. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for supply research and development plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition, as follows:

(A) Fossil:

(1) Project 81–T–401, renovation of south wing, Building 3–B Bartlesville Energy Technology Center, Oklahoma, $1,200,000;

(2) Project 81–T–404, General Plant Projects for Technology Centers, six locations, $3,000,000;

(3) Project 81–T–405, Atmospheric Fluidized Bed Combustion-Industrial Demonstration Projects (sites undetermined), an additional sum of $10,000,000, for a total project authorization of $14,300,000;

(4) Project 81–T–406, Coal-Oil Mixtures Demonstration Projects (sites undetermined), $7,000,000;

(5) Project 80–FE–3, Program Support Facility, Pittsburgh Energy Technology Center, Pennsylvania, an additional sum of $2,200,000 for a total project authorization of $3,900,000;

(6) Deauthorize project 80–FE–10, Atmospheric Fluidized Bed Combustion Component Test and Integration Unit, Morgantown, West Virginia, by a sum of $10,000,000, for a total project authorization of $27,200,000;

(7) Project 80–FE–11, Pressurized Fluidized Bed Combined Cycle Pilot Plant, Woodbridge, New Jersey, an additional sum of $9,200,000 for a total project authorization of $39,000,000;

(8) Project 79–1–r, SRC–II (liquids) Demonstration Plant, Morgantown, West Virginia, an additional sum of $160,000,000 for a total project authorization of $250,000,000;

(9) Project 78–2–D, SRC–I (solids) Demonstration Plant, Owensboro, Kentucky, an additional sum of $150,000,000, for a total project authorization of $260,000,000;

(10) Project 77–1–b, Second High Btu Synthetic Pipeline Gas Demonstration Plant, Noble County, Ohio, an additional sum of $38,000,000 for a total project authorization of $48,000,000; and

(11) Project 76–1–B, First High Btu Synthetic Pipeline Gas Demonstration Plant, Perry County, Illinois, an additional sum of $5,000,000 for a total project authorization of $127,000,000.

(B) Solar Technology:

(1) Project 81–T–305, Ethanol from Biomass Production/Conversion System, location to be determined, $2,500,000;

(2) Project 80–ES–2, Shenandoah Solar Total Energy Project, Shenandoah, Georgia, an additional sum of $5,800,000, for a total project authorization of $11,700,000;

(3) Project 80–ES–19, Small Community Solar Thermal Power Experiment, location to be determined, an additional sum of $3,750,000, for a total project authorization of $7,545,000;

(4) Project 79–1–Q, Solar Energy Research Institute facility, Golden, Colorado, an additional sum of $7,000,000, for a total project authorization of $16,900,000;

(5) Project 76–2–b, Ten Megawatt Central Receiver Solar Thermal Powerplant, Barstow, California, an additional sum of $10,000,000, for a total project authorization of $118,000,000;

(6) Project 81–H–04, First, Advaced Medium Scale Wind Turbine (MOD–6), vertical axis, site to be determined, $1,000,000;

(7) Project 81–H–05, Second Advanced Medium Scale Wind Turbine (MOD–6), horizontal axis, site to be determined, $1,000,000;

(8) Project 81–H–06, First Advanced Multimegawatt Wind Turbine (MOD–5), site to be determined, $2,500,000;

(9) Project 81–H–07, Second Advanced Multimegawatt Wind Turbine (MOD–5), site to be determined, $2,500,000;

(10) Project 81–H–10, six additional Advanced Multimagawatt Wind Turbines (MOD–5), various locations, $5,000,000.

(C) Geothermal:

(1) Project 80–G–1, Geothermal Demonstration Powerplant Project, Valles Caldera, New Mexico, an additional sum of $8,911,000, for a total project authorization of $48,340,000; and

(2) Project 80–G–2, Second 50 Megawatt Electrical Demonstration Powerplant, site to be determined, an additional sum of $10,000,000, for a total project authorization of $18,000,000.

(D) Nuclear Fission:

(1) Project 81–T–301, General Plant Projects, Richland, Washington, $2,000,000;

(2) Project 81–H–01, First Technology Demonstration Repository, site undetermined, $6,000,000. Site surveys, design and site selection shall be initiated immediately upon passage of the Act. Construction of primary shaft to full depth shall be started in fiscal year 1981. Construction shall be completed, ready for operation, in fiscal year 1986;

(3) Project 81–H–02, Second Technology Demonstration Repository, site undetermined, $2,000,000. Site surveys, design and site selection shall be initiated immediately upon passage of the Act. Construction shall be completed, ready for operation, in fiscal year 1987;

(4) Project 81–H–03, Nuclear Waste Solidification Demonstration Facility site undetermined, $1,000,000. Design and site selection shall be started immediately upon passage of the Act. Construction shall be completed, ready for operation, by fiscal year 1985;

(5) Project 81–T–310, General Plant Projects, $8,000,000;

(6) Project 81–T–311, Support Services Building, Hanford Engineering and Development Laboratory, Washington, $1,000,000;

(7) Project 81–T–312, General Plant Project, test reactor area, radioactive and nonradioactive liquid waste systems, phase II, Idaho National Engineering Laboratory, Idaho, $800,000;

(8) Project 80–ES–12, Near Surface Test Facility, Phase II (nuclear waste), Richland, Washington, an additional sum of $3,576,000, for a total project authorization of $11,850,000;

(9) Project 79–1–c, Security and Safeguards Improvements, Richland, Washington, an additional

sum of $3,000,000, for a total project authorization of $12,000,000;

(10) Project 78-6-e, Liquid Metal Engineering Center Modifications, Santa Susanna, California, an additional sum of $7,400,000, for a total project authorization of $20,900,000; and

(11) Project 78-6-f, Fuels and Materials Examination Facility, Richland, Washington, an additional sum of $62,000,000, for a total project authorization of $145,200,000.

(E) Magnetic Fusion:

(1) Project 81-T-313, General Plant Projects, $4,400,000;

(2) Project 81-MF-1, Fusion Engineering Test Faciilty, site to be determined, $7,000,000;

(3) Project 81-MF-2, Impurity Studies Experiment Modification (ISX-C), Oak Ridge, Tennessee, $10,000,000;

(4) Project 81-MF-3, Fusion Research Center, Massachusetts Institute of Technology, Boston, Massachusetts, $200,000;

(5) Project 80-MF-3, Elmo Bumpy Torus, proof of principal, location to be determined, an additional sum of $42,000,000, for a total project authorization of $51,100,000;

(6) Project 80-MF-4, Large Coil Test Facility, Oak Ridge, Tennessee, an additional sum of $6,500,000, for a total project authorization of $16,950,000;

(7) Project 78-3-a, Mirror Fusion Test Facility, Lawrence Livermore Laboratory, California, $30,000,000, for a total project authorization of $124,200,000;

(8) Project 78-3-b, Fusion Materials Irradiation Test facility, Richland, Washington, an additional sum of $57,600,000, for a total project authorization of $88,900,000; and

(9) Project 76-5-a, Tokamak Fusion Test Reactor, Princeton Plasma Physics Laboratory, Plainsboro. New Jersey, an additional sum of $40,000,000, for a total project authorization of $278,600,000.

(F) Environment:

(1) Project 81-E-305, general plant projects, $3,000,000; and

(2) Project 81-E-306, modifications and additions to environmental research facilities, various locations, $3,400,000.

(G) Supporting Research:

(1) Project 81-E-301, General Plant Projects, $300,000;

(2) Project 81–E–304, Accelerator Improvements and Modifications, Oak Ridge National Laboratory, Oak Ridge, Tennessee, $200,000;

(3) Project 81–E–308. Energy Systems Research Laboratory (ESRL), Oak Ridge National Laboratory, Oak Ridge, Tennessee, $2,000,000;

(4) Project 81–E–309, rehabilitation of general purpose physical plant, Argonne, Illinois, $10,100,000;

(5) Project 81–E–310, transmission and distribution systems upgrading, Richland, Washington, $6,050,000;

(6) Project 81–E–311, Energy Science and Technology Building expansion, Brookhaven National Laboratory, New York, $12,000,000;

(7) Project 81–E–312, Environment and Energy technology facility, Richland, Washington, $4,000,000;

(8) Project 81–E–313, Central Energy Conservation Facility, Brookhaven National Laboratory, New York, $7,100,000;

(9) Project 81–E–314, energy utilization improvements, Brookhaven National Laboratory, New York, $2,000,000;

(10) Project 81–E–315, Centralized Cogeneration, with chilled and hot water distribution, Argonne National Laboratory, Illinois, $7,400,000;

(11) Project 81–E–316, Boiler Number 3 replacement, Brookhaven National Laboratory, New York, $3,000,000;

(12) Project 81–E–317, roof replacement, Idaho National Engineering Laboratory, Idaho, $4,300,000;

(13) Project 81–E–318, upgrade primary substation, Oak Ridge, National Laboratory, Oak Ridge, Tennessee, $3,500,000;

(14) Project 81–E–319, Coal-Fired Atmospheric Fluidized-Bed Boiler, Argonne National Laboratory, Illinois, $7,100,000;

(15) Project 81–E–321, Site Utilities Project, Lawrence Livermore National Laboratory, California, $7,900,000;

(16) Project 81–E–322, Scoville Substation Distribution System upgrade, Idaho National Engineering Laboratory, $1,000,000;

(17) Project 81–E–323, Fire Safety Improvements, Argonne National Laboratory, Illinois, and Idaho National Engineering Laboratory, Idaho, $4,100,000;

(18) Project 81–E–324, Fire Safety and Protection Improvements, Idaho National Engineering Laboratory, Idaho, $3,400,000; and

(19) Project 81–H–08, energy technology building, Sandia Laboratory, Albuquerque, New Mexico, $1,000,000.

(H) High Energy Physics:

(1) Project 81–E–218, Tevatron, Phase I, Fermi National Accelerator Laboratory, Illinois, $27,000,000;

(2) Project 81–E–219, Accelerator Improvements and Modifications, various locations, $6,000,000;

(3) Project 81–E–220, General Plant Projects, $5,000,000;

(4) Project 79–9–b, Energy Saver, Fermi National Accelerator Laboratory, Batavia, Illinois, an additional sum of $19,600,000, for a total project authorization of $46,600,000; and

(5) Project 78–10–b, intersecting storage accelerator (ISABELLE) 400x400 GeV, Brookhaven National Laboratory, Upton, New York, an additional sum of $65,000,000, for a total project authorization of $143,500,000.

(I) Nuclear Physics:

(1) Project 81–E–221, Accelerator Improvements and Modifications, various locations, $1,600,000;

(2) Project 81–E–222, General Plant Projects, $2,800,000;

(3) Project 81–E–223, Argonne Tandem-linac Accelerator System, Argonne National Laboratory, Illinois, (A&E and long-lead procurement only), $400,000; and;

(4) Project 80–GS–5, National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, Michigan, an additional sum of $8,900,000, for a total project authorization of $14,900,000.

(J) Uranium Enrichment Activities:

(1) Project 81–T–501, Isotope Research and Development Laboratory, New Mexico, $1,500,000;

(2) Project 81–T–502, Advanced Isotope Separation Laboratory, Lawrence Livermore National Laboratory, California, $1,800,000,

(3) Project 81–T–504, General Plant Projects, $2,970,000; and

(4) Project 78–5–c, Laser Isotope Separation Facility, Richland, Washington, an additional sum of $1,000,000, for a total project authorization of $4,500,000.

c. 121. Within 90 days after the date of enactment of this the Secretary shall transmit to both Houses of Congress port detailing the Department of Energy's policy and ion on sharing costs, and facilities and technologies as ractually negotiated for large coal conversion demonion and pilot plant design, construction and operation.

The applicable contract provision shall include, but not be limited to—

(A) Contract cost sharing;
(B) Overrun cost sharing;
(C) Process/patent exclusivity; and
(D) Facility plant purchase.

SEC. 122. (A) Within 90 days after the date of enactment of this Act, the Secretary shall transmit to both Houses of Congress a detailed description of the comprehensive, multiyear program plan for energy conservation research, development, and demonstration.

(B) The description of the comprehensive program plan submitted under subsection (A) shall include—

(1) the anticipated research, development and demonstration multiyear objectives to be achieved by the program;

(2) the program elements, management structure, and activities, including any regional aspects and field responsibilities thereof;

(3) an evaluation of whether such program elements and activities are adequate to meet such multiyear objectives;

(4) the program strategies and commercialization plans, including detailed milestone goals to be achieved during the next fiscal year for all major programs and projects;

(5) the economic, environmental and societal significance which the program may have;

(6) the total estimated cost of individual program items;

(7) the estimated relative financial contributions of the Federal Government and non-Federal participants in the program;

(8) the relationship of the program to any Federal national energy or fuel policies; and

(9) the relationship of any short-term undertakings and expenditures to long-range goals and comprehensive conservation strategy.

SEC. 123. No funds appropriated pursuant to any authorization in this title may be obligated for expenditure or expended by the Secretary to—

(A) place, bury, or store in any subsurface geologic repository any irradiated nuclear fuel assembly, or part thereof, from any nuclear reactor unless the geologic repository is designed so that all fuel assemblies, or parts thereof, to be placed, buried or stored can be easily and economically retrieved; or

(B) design or construct spent fuel cansisters or containers intended for permanent emplacement in any repository.

Nothing in this section shall be construed to prohibit the placement, burial, or storage of reprocessing wastes which have been glassified, vitrified, or otherwise appropriately treated to provide long-term isolation from the biosphere.

Sec. 124. (A) With respect to Department of Energy civilian research and development programs, the Federal share of each plant and capital equipment construction project, other than a construction project for which funds are authorized under section 107(E)(1)(b) of this Act, shall be funded exclusively from an account separate from operating expenses; and, for purposes of the President's annual budget submission and of related reports submitted by the Secretary to the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate, each plant and capital equipment construction project shall be assigned or reassigned to one of the following categories:

(1) Major Construction Projects.—All construction projects having a total estimated Federal cost of $5,000,000 or more. Each such project shall be set forth by name, location, total estimated cost, total estimated Federal cost, description, justification, cost details, and outlays for pertinent fiscal years. Appropriate documentation shall also be provided.

No major construction project authorized by this Act shall, after Title I design is completed, be substantially reduced in scope in order to stay within the current total estimated cost unless (a) a period of thirty calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than three calendar days to a day certain) has passed after the receipt by the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate of notice given by the Secretary containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of such proposed action, or (b) each such committee before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the proposed action.

(2) Minor Construction Projects.—All construction projects having a total estimated Federal cost between $1,000,000 and $5,000,000. These projects within each program area may be submitted in combined form. Accompanying documentation shall include the name, location, description, total estimated cost, and total estimated Federal cost of each project. By December 1 of each year, the Secretary shall issue a report to each such Committee describing all changes in the list of these projects and in the funding among them.

(3) General Plant Projects.—All general plant construction projects having a total estimated Federal cost of up to $1,000,000. These projects within each program area may be consolidated into one item.

(4) Planning and Design.—The architect and engineering phase for construction projects (title I design and title II design) within each program area may be combined into one item. Site work or other construction activities may not be included. Accompanying documentation shall include a description by subprogram of the effect, purpose, and estimated cost of such planning and design.

Notwithstanding the preceding provisions of this section, operating expenses may be used for (a) any construction project having a total estimated Federal cost of $500,000 or less, (b) the conceptual design of any project, (c) the procurement and installation of individual components fabricated for research and development or testing when such components are not an integral part of a basic facility or construction project, (d) experimental test equipment to conduct specific investigations but not for long-term research and development use, and (e) solar heating and cooling demonstrations.

For major construction projects where it is in the national interest to initiate construction in advance of the next annual budget cycle, the Secretary or Under Secretary shall notify the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate sixty days in advance of commencing construction under this section, shall provide those committees with a detailed justification for commencing construction in advance of such cycle, shall (subject to the applicable limitations in title VIII) reprogram necessary funding from other major construction projects, and shall inform those committees of the sources of the funding and of the effect on the particular projects from which the funding was taken.

(B) For purposes of this section—

(1) the term "total estimated Federal cost" with respect to a construction project means the most current estimate of the cost which will be borne by the United States Government of all activities ultimately constituting a part of the project;

(2) the term "total estimated cost" with respect to a construction project means the most current estimate of the cost of all activities ultimately constituting a part of the project;

(3) the term "construction project" means the design, construction, or modification of a Department of Energy civilian research and demonstration facility, including buildings, test facilities, pilot and demonstration plants, processing and reprocessing plants, utilities, and improvements; and for this purpose (a) only facilities uniquely related to a larger construction project may be combined with that project, and (b) when minor construction projects or general plant projects are submitted in combined form, completed projects including

all dedicated equipment must always be used in these submissions;

(4) the term "conceptual design" means the formative stage in the design of a facility leading to preliminary estimates of size, capabilities, and design criteria and an initial understanding of the interrelationships among the facility's significant features;

(5) the term "title I design" means the refinement of the design concept by means of preliminary engineering drawings, outline specifications, cost estimates, and schedules, the identification of long-lead procurement, site improvements, and applicable code standards, and the consideration of structural, hydraulic, chemical, mechanical, and electric constraints and capabilities; and

(6) the term "title II design" means the development of the details of each aspect of title I design to the point where a contractor can order the components and proceed with construction, including complete engineering calculations considering all applicable codes, standards, and contract provisions, detailed specifications, dimensioned drawings, and procurement data, a precise cost estimate, and a firm construction schedule.

(C) As used in this section, the term "program" includes any of the categories listed in subsection (A) of this section, and any construction project included in the category of major construction projects as described in paragraph (1) of such subsection: *Provided*, That if the current total estimated Federal cost of any major construction project exceeds the original estimated Federal cost by more than 10 percent, such funds may be acquired from other major construction projects upon written notice to the Committee on Science and Technology of the House of Representatives and the Energy and Natural Resources Committee of the Senate.

(D) Whenever the provisions of this section conflict or are inconsistent with any other provision of this Act or the Energy Reorganization Act of 1974, Public Law 93-438, as amended, the provisions of this section shall govern.

SEC. 125. The Secretary of the Department of Energy is directed to establish a new separate activity at the Headquarters level, to be known as the Research and Development Construction and Facilities Office. The activity is established for the purpose of providing construction services including establishing construction and maintenance policies, design standards, project budgets and field reports verifying field progress, coordinating five-year plans for institutional maintenance, modification and construction, and similar related activities. The sum of $400,000 is authorized for program management and support.

SEC. 126. The Secretary shall, upon enactment of this Bill, assigned a qualified panel of engineers and architects, composed of seven members, to review and report on the design of all planned laboratory/office facilities under the control of the Secretary of Energy and those also under the control of the Secretary for which appropriations have been made but where construction has not proceeded beyond the foundation stage. (A) After this design review, the Secretary shall prepare a report to the House Committee on Science and Technology and the Senate Committee on Energy and Natural Resources describing each facility, its estimated costs of the essential features, substantiating its need, justifying its all features and all associated equipment and offering alternatives for reducing the costs of each in order to minimize construction costs consistent with functional requirements. (B) in addition, such facilities shall include solar energy and conservation features which are cost effective after taking into consideration the capital and operating costs of such features which can be recovered over their expected useful life not to exceed twenty-five years, including a real rate of return of 7 per centum per year. (C) The report shall also include recommended measures that could be taken to accelerate the construction of such projects once they have been authorized in order to further reduce costs.

An initial design review report of each facility shall be submitted within 120 calendar days after enactment of this Bill, or within 120 days after completion of Title I (Preliminary Engineering) to the committees listed in paragraph (A). The committees shall be given 60 calendar days (not including any day in which either House of Congress is not in session because of an adjournment of more than three calendar days to a day certain of an adjournment sine die) in which to review the report, unless prior to the expiration of such period, each committee, listed in paragraph (A), has transmitted to the Secretary written notice to the effect that such committee has no objection to the proposed facility.

Sec. 127. As of the date of enactment of this Act, all funds authorized to be appropriated pursuant to Public Law 96–126 for research, development, and demonstration shall be deemed subject to the requirements of Sec. 111(b) of the Energy Reorganization Act, as amended.

Strike out Title VI (beginning on p. 20, line 22 and ending on p. 21, line 21) and insert the following substitute text:

TITLE VI—OTHER RENEWABLE RESOURCES AND CONSERVATION ACTIVITIES

AUTHORIZATION

Sec. 601. There are authorized to be appropriated to the Department of Energy for the fiscal year ending September 30, 1981, not to exceed—

(A) in the case of fossil energy activities, operating expenses—

(1) $6,191,000 for coal utilization and supply functions;

(2) $8,345,000 for oil and gas development functions; and

(3) $551,000 for program administration functions;

(4) There is hereby authorized to be appropriated from the funds available under the Energy Security Reserve established by P.L. 96–126, to carry out the provisions of the Non-Nuclear Act up to $30,000,000 for eligible projects to demonstrate the upgrading of heavy oil with a specific gravity of 10° or less.

(B) in the case of fossil energy activities, construction projects—

Project 80–FE–12, Peat Fueled Combustion Demonstration plant (site undetermined), $3,100,000.

(C) in the case of solar energy activities—

(1) $46,500,000 for market development and training functions, of which up to $1,000,000 shall be used for the preparation of a comprehensive program and management plan pursuant to section 602; and

(2) $4,000,000 for international applications of solar technology; and

(D) in the case of conservation activities—

(1) $37,800,000 for functions regarding buildings and community systems including $800,000 for capital equipment;

(2) $11,000,000 for industrial conservation functions;

(3) $20,000,000 for energy extension service functions;

(4) $47,800,000 for State and local conservation functions under part C of title III of the Energy Policy and Conservation Act;

(5) $10,000,000 for emergency grants; and

(6) $20,100,000 for appropriate technology functions.

SEC. 602. Within six months after the date of enactment of this Act, the Secretary shall transmit to both Houses of Congress a detailed description of the comprehensive program and management plan for the conservation and solar technology transfer programs in the Department of Energy, including the Energy Extension Service, the National Solar Heating and Cooling Information Center, and the Regional Solar Energy Centers. Such plan shall include a detailed description of the roles, division of responsibilities, and relationships of such Centers with activities of the Department of Energy, including the Energy Extension Service, the Solar Energy Information Data Bank, and the National Solar Heating and Cooling Information Center.

Strike out Title VII (beginning on p. 21, line 22 and ending on p. 26, line 4) and insert the following substitute text:

TITLE VII—OTHER DEPARTMENTAL ACTIVITIES

AUTHORIZATION

SEC. 701. There are authorized to be appropriated to the Department of Energy for the fiscal year ending September 30, 1981, not to exceed—

(A) for uranium enrichment operating expenses—

(1) $782,926,000 for purposes of gaseous diffusion operations and support;

(2) $800,000 for purposes of gas centrifuge operations and support; and

(3) $3,060,000 for purposes of uranium enrichment program direction;

(B) for uranium enrichment construction projects—

(1) $17,500,000 for purposes of project 81–R–501, General Plant Projects;

(2) $8,000,000 for purposes of project 81–R–502, UF–6 cylinders and storage yards, gaseous diffusion plants;

(3) $27,000,000 for purposes of project 81–R–503, utilities upgrading, gaseous diffusion plants;

(4) $13,000,000 for purposes of project 81–R–504, Supervisory Control and Data Acquisition Systems, gaseous diffusion plants, Paducah, Kentucky, and Portsmouth, Ohio;

(5) $6,000,000 for purposes of project 81–R–505, instrumentation for purge cascades and withdrawal areas, gaseous diffusion plants;

(6) $36,000,000 for purposes of project 81–R–506, environmental protection and safety modifications, Phase I, gaseous diffusion plants;

(7) $4,700,000 for purposes of project 80–UE–1, control of gaseous diffusion effluents, gaseous diffusion plants, Oak Ridge, Tennessee, and Paducah, Kentucky (for a total project authorization of $7,000,000);

(8) $9,500,000 for purposes of project 80–UE–2, control of water pollution, gaseous diffusion plants (for a total project authorization of $17,000,000);

(9) $12,500,000 for purposes of project 80–UE–3, plant facilities security improvements, gaseous diffusion plants (for a total project authorization of $17,000,000);

(10) $7,000,000 for purposes of project 80–UE–4, power recovery demonstration cells, gaseous diffusion plants (for a total project authorization of $10,500,000);

(11) $20,600,000 for purposes of project 80–UE–5, motor and switchgear upgrading, gaseous diffusion plants (for a total project authorization of $28,500,00);

(12) $116,325,000 for purposes of project 76-8-g, Enriched Uranium Production Facilities, Portsmouth, Ohio (for a total project authorization of $951,630,000); and

(13) Deauthorize project 71-1-f, process equipment modifications, gaseous diffusion plants, in the amount of $111,600,000 (for a total project authorization of $970,000,000).

(C) $24,000,000 for purposes of uranium enrichment capital equipment not related to construction;

(D) for operating expenses for administrative activities of the Department—

(1) $14,200,000 for purposes of policy analysis and systems studies;

(2) $4,100,000 for international affairs functions;

(3) in the case of management and support—

(a) $172,301,000 for purposes of salaries and expenses; and

(b) $107,864,000 for purposes of support services;

(4) $34,243,000 for intergovernmental and institutional relations functions;

(5) $3,900,000 for in-house energy management functions;

(6) $15,012,000 for security investigations; and

(7) $55,803,000 for purposes of cost of work for others, and changes in inventory and other supporting activities;

(E) for construction for the administrative activities of the Department—

(1) $28,200,000 for purposes of project 81-A-601, Modifications for Energy Management, various locations;

(2) $9,000,000 for purposes of project 81-C-601, Plant Engineering and Design;

(3) $5,000,000 for purposes of project 81-A-602, Energy Monitoring and Control System, Y-12 plant, Oak Ridge, Tennessee;

(4) $4,000,000 for purposes of project 81-A-603, Energy Monitoring and Control System, Oak Ridge National Laboratory, Tennessee;

(5) $3,000,000 for purposes of project—81-A-604, Heat Recovery and Night Setback, heating, ventilating and air conditioning systems, Richland, Washington;

(6) $3,800,000 for purposes of project 81-A-605, Automated Energy Management System, Argonne National Laboratory, Argonne, Illinois; and

(7) $12,300,000 for purposes of project 80-DA-6, Alternate Energy Source, Pantex plant, Texas (for a total project authorization of $12,300,000); and

(F) $5,165,000 for capital equipment acquisition and fabrication not related to construction for purposes of the administrative activities of the Department.

(G) for civilian waste management, operating expenses—

(1) $2,000,000 for site and repository licensing;

(2) $500,000 for support studies; and

(3) $900,000 for low level waste management operations.

(H) $2,500,000 for purposes of plant and capital equipment for storage of spent nuclear fuel, as a nuclear fuel cycle center, and for nuclear safeguards research and development. Project 81-H-11, Barnwell Nuclear Fuel Plant, Barnwell, South Carolina. The funds authorized by this subsection shall be used for the purposes of negotiating with the Owners of the Barnwell Nuclear Fuel Plant to acquire that facility by sale, lease or condemnation. All negotiations shall be completed prior to the submission of the Fiscal Year 1982 budget to the Congress. Such negotiations should include lease of the appropriate land, buildings and access for interim use for storage of spent nuclear fuel until a contract has been signed for acquisition of the facility.

(I) $7,000,000 for nuclear fission, for capital equipment acquisition to establish a nuclear emergency response capability in the eastern United States.

Sec. 702. (A) As soon as practicable but not later than the date on which the Secretary transmits to the Congress legislation authorizing appropriations for the Department of Energy for fiscal year 1982 the Secretary shall transmit to the President and the Committees on Interstate and Foreign Commerce, Interior and Insular Affairs, the Committee on Foreign Affairs and Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the long term policy and plan for U.S. uranium enrichment.

(B) The report required under this subsection shall provide a full and complete statement of the Department's policy governing commercial uranium enrichment services and an associated plan, with appropriate projections, to the year 2000. The report of the policy and plan shall include, but not be limited to:

(1) the enrichment policies of the U.S. government, including preproduced enriched uranium inventory managment, international market share and nonproliferation objectives, and timing for decisions on new capacity additions including energy efficient advanced isotope separation technology;

(2) operations of the current and authorized enrichment facilities, including operating and transaction tails assay, elcetric power purchase commitments and availability, and incremental replacement of gaseous diffusion capacity with energy efficient centrifuge capacity;

(3) enrichment service contract demand for domestic civilian and military uses, and for foreign civilian uses;

(4) international commitments related to the Nuclear Non-Proliferation Act of 1978, nuclear fuel-bank set-asides, and any bulk purchase agreements including purchase of feed or tails materials;

(5) estimated annual on-budget costs and total estimated project cost for each increment of authorized and projected additional capacity;

(6) projection of anticipated revenues including foreign exchange;

(7) recommendations for opportunities to encourage private sector involvement in funding; manufacturing, construction, and operation of future increments of enrichment capacity as a supplement to existing government commitments.

(8) impact of domestic uranium production capability and resource availability on enrichment operations, including constraints on uranium production due to land withdrawal.

Strike out title VIII (beginning on p. 26, line 5 and ending on p. 26, ine 10) and insert the following substitute text:

Sec. 801. (A) No amount appropriated pursuant to this Act (other han title I and title VI) may be used for any function or purpose excess of the amount expressly authorized to be appropriated for hat function or purpose by this Act, nor may the amount available or any function or purpose from sums appropriated pursuant to this ct (other than title I and title VI) be reduced by more than 5 percent of the total of the sums appropriated pursuant to this Act for uch function or purpose or by more than $10,000,000 (whichever is he lesser), except that such funds may be so used (and available unds so reduced) in any case in which—

(1) a period of 30 calendar days (not including any day in which either House of Congress is not in session because of an adjournment of more than 3 calendar days to a day certain or an adjournment sine die) has passed after the receipt by the appropriate authorizing committees of the House of Representatives and the Senate of notice given by the Secretary of Energy or the Federal Energy Regulatory Commission, as the case may be, containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of the proposed action, or

(2) each such committee before the expiration of such period has transmitted to the Secretary of Energy or the Federal Energy Regulatory Commission, as the case may be, written notice stating in substance that such committee has no objection to the proposed action.

(B) In the case of any office or unit within the Department to hich funds are authorized to be appropriated without reference to particular function or purpose, paragraph (A) of this subsection hall be applied to such office or unit as if the references in such subsection to "function or purpose" were to that office or unit.

(C) At the time of any reprograming of funds appropriated pursuant to this Act (other than title I and title VI), the Department shall report to the appropriate authorizing committees of the House of Representatives and the Senate the nature and amount of, and reasons for, such reprograming.

(D) (1) Except as otherwise provided in this Act—

(a) no amount appropriated pursuant to title I or title VI of this authorization Act may be used for any program in excess of the amount expressly authorized for that particular program by this Act, and

(b) no amount appropriated pursuant to title I or title VI of this authorization Act may be used for any program which has not been presented to or requested of the Congress,

except that such funds may be so used in any case in which (i) a period of 30 calendar days (not including any day in which either House of Congress is not in session because of adjournment of more than 3 calendar days to a day certain) has passed after the receipt by the Committee on Science and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate of notice given by the Secretary containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of such proposed action, or (ii) each such committee before the expiration of such period has transmitted to the Secretary written notice to the effect that such committee has no objection to the proposed action.

(2) Nowithstanding any other provision of this Act, the aggregate amount of funds appropriated pursuant to the authorization contained in any of the following provisions of this Act shall not, as a result of reprograming, be decreased by more than 10 percent:

Section 101 (A), (B), (C), (D), (E), (F), (G), (H), (I), (J), or (K);
Section 102 (A), (B), (C), (D), or (E);
Section 103 (A), (B), (C), or (D);
Section 104 (A), (B), (C), (D), or (E);
Section 105 (A), (B), or (C);
Section 106 (A) or (B);
Section 107 (A)(1)(a), (A)(1)(b), (A)(1)(c), (A)(1)(d), (B)(1)(a), (B)(1)(b), (D), (E)(1)(a), (E)(1)(b), (E)(1)(c), (E)(2), (E)(3), (E)(5), or (F);
Section 108 (A)(1), (A)(2), (A)(3), (A)(4), or (B);
Section 109 (A), (B), or (C);
Section 111 (A) or (B);
Section 112 (A) or (B);
Section 113 (A), (B), (C), (D), (E), or (F);
Section 114 (A), (B), (C), or (D);
Section 115 (A), (B), or (C);
Section 116 (A), (B), or (C);
Section 117 (A)(1) or (A)(2);
Section 118 (A), (B), or (C); and
Section 119 (E)(2), (E)(5)(a), (F)(1)(a), (F)(1)(b), (J), (K), or (N).

LIMITATION ON THE USE OF CERTAIN REVENUES

802. (A) When so specified in an appropriation Act, (1) any es received in the fiscal year ending September 30, 1981, by epartment in providing uranium enrichment services may be ed and used solely for the purpose of offsetting any costs in- by the Department in conducting uranium enrichment service ies for which funds are authorized to be appropriated by this otwithstanding the provisions of section 3617 of the Revised es (31 U.S.C. 484), and (2) the amount of appropriated funds would otherwise be available for obligation or expenditure for ctivities for such fiscal year shall be reduced by the amount of venues so retained. Revenues from other programs shall not be ble during such fiscal year for such activities.

Except as otherwise provided in subsection (802)A or as cally provided by any other law, receipts of the Secretary and mmission during the fiscal year ending September 30, 1981, in- g any payment received in such fiscal year because of over- s by persons under the jurisdiction of the Secretary or the Com- n, shall be deposited in the Treasury of the United States as mis- ous receipts in accordance with section 3617 of the Revised Stat- 1 U.S.C. 484).

) The reprogramming authority authorized under section 801 Act or under any other reprogramming authority shall not with respect to uranium enrichment service activities conducted Department and to any uranium enrichment revenues."

This section does not apply to the power marketing functions Department.

Subsection (h) of section 111 of the Energy Reorganization 1974 (42 U.S.C. 5821) shall not apply with respect to the fiscal nding September 30, 1981.

LIMITATION ON THE USE OF UNEXPENDED BALANCES

. 803. (A) If so specified in an appropriation Act, the unex- d balances of any appropriations to the Department for—

(1) operating expenses,
(2) plant and capital equipment, or
(3) any program, purpose, or function not covered under para- raphs (1) and (2),

e transferred to the new appropriation account established for me program, purpose or function pursuant to an appropriation rized by this Act, and balances so transferred may be merged unds in the applicable newly established account and thereafter e accounted for as one fund for the same time period as originally d; except that no such amounts appropriated for plant and l equipment may be merged with amounts appropriated for op- g expenses. The Secretary of Energy shall report such transfers appropriate committees of the Congress within 30 days after g such a transfer.

No limitation under any other section of this Act applicable funds shall be considered to be inapplicable by reason of this n.

PERSONNEL EXPENSES

SEC. 804. Appropriations authorized by this Act for salary, pay, retirement, or other benefits for Federal employees for the fiscal year ending September 30, 1981, may be increased by such amounts as may be necessary for increases in such benefits authorized by law.

LIMITATION ON CONTRACTING

SEC. 805. Any authority under this Act to enter into contracts obligating the United States to make outlays may be exercised only to the extent as may be provided in advance in appropriation Acts.

MILITARY APPLICATIONS

SEC. 806. (A) Nothing in this Act shall apply with respect to any authorization in any other law for appropriations for the fiscal year ending September 30, 1981, for any military application of nuclear energy, for research and development in support of the armed forces, or for the common defense and security of the United States.

(B) For purposes of subsection (a):

(1) The term "military application" means any activity authorized or permitted by chapter 9 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2121, 2122).

(2) The term "research and development", as used in this section is defined by section 11 x. of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2014).

(3) The term "common defense and security" means the common defense and security of the United States as used in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.).

INTERAGENCY TRANSFERS

SEC. 807. If so specified in an appropriation Act, funds authorized to be appropriated by this Act for operating expenses may be transferred to other agencies of the Government for the performance of the work for which the appropriation is made, and in such cases the sums so transferred may be merged with the appropriations to which they are transferred. Except to the extent expressly provided, no limitation under this Act applicable to any funds shall be considered to be inapplicable by reason of this section.

OPERATING EXPENSES

SEC. 808. (A) Amounts appropriated for operating expenses for research, development, and demonstration programs pursuant to authorizations in titles VI and VII of this Act may not be used for—

(1) for the acquisition of land, except as provided in subsection (B), and

(2) for any item of equipment, if the estimated cost to the Federal Government of such item exceeds $2,000,000, unless such item has been previously authorized by statute or the use of such funds is in accordance with subsection (C).

Subject to subsection (C), the Secretary may use up to 1 per-
all funds appropriated pursuant to authorizations in titles I,
l VII of this Act for operating expenses for research, develop-
ınd demonstration programs may be used by the Secretary of
to construct, expand, modify, or acquire any facilities, includ-
oratories or major items of equipment, or to acquire land at any
a under the control of the Secretary, if—
(1) the Secretary determines, in writing, that—
(a) such action would be necessary because of changes in
the national programs authorized to be funded by this Act or
because of new scientific or engineering developments, and
(b) deferral of such action until the enactment of the next
authorization Act would be inconsistent with the policies
established by Congress for the Department, and
(2) in the case of any project the estimated cost of which ex-
eds $50,000, the determination under paragraph (1) is made in
cordance with subsection (C).

No action required to be made in accordance with this subsec-
all take effect unless—
(1) a period of 30 calendar days (not including any day in
ich either House of Congress is not in session because of an
journment of more than 3 calendar days to a day certain) has
ssed after the Secretary has transmitted to the Committee on
ience and Technology of the House of Representatives and the
mmittee on Energy and Natural Resources of the Senate a
itten report containing a full and complete statement concern-
g the proposed action, including—
(a) in the case of the vesting of property under subsec-
tion (B), the reasons for determining such vesting to be
appropriate, and
(b) in the case any obligation or expenditure of funds
under subsection (B), the nature of the construction, ex-
pansion, or modification involved, the cost thereof, including
the cost of any real estate action pertaining thereto, and the
reason why such construction, expansion, or modification is
necessary and in the national interest, or
(2) each such committee before the expiration of such period
s transmitted to the Secretary a written notice to the effect that
ch committee has no objection to the proposed action.

EXEMPTION FROM FISCAL YEAR LIMITATION

. 809. (A) Authorizations in this Act for any construction line
project shall remain effective without fiscal year limitation
gh the fiscal year ending September 30, 1983, except that any
uthorization may remain available without fiscal year limitation
l that date—
(1) if funds to carry out the projects involved are appro-
riated or otherwise provided pursuant to applicable law prior
ereto, or
(2) if such authorization period is specifically extended by
atute enacted after the date of the enactment of this Act, but
ly to the extent specifically so extended.

(B) If so specified in an appropriation Act, any amount appropriated pursuant to this Act may remain available until expended.

COORDINATION WITH THE ENERGY REORGANIZATION ACT OF 1974

SEC. 810. With respect to the fiscal year 1981, the provisions of this title shall supersede the provisions of section 111 of the Energy Reorganization Act of 1974.

I. BACKGROUND OF BILL

The fiscal year 1981 Department of Energy budget was submitted
the House of Representatives on January 28, 1980 by President
rter. The formal authorization request in bill form for DOE civil-
programs was submitted on February 21, 1980.

On February 26, 1980 the DOE Authorization Bill for fiscal year
81 (H.R. 6627) was introduced in the House of Representatives by
airman Don Fuqua and others, and referred in part to the Committee
Science and Technology.

Extensive Subcommittee hearings were held during February and
arch on the Department of Energy authorization requests. On
pril 16, 17, 22, 23, 29, May 6, 7 and 8, 1980, the Committee met to
ark up the bill. After completing this action, the Committee ordered
ported the bill, H.R. 6627, as amended, on May 8, 1980, by a recorded
te, a quorum being present.

II. HEARINGS

A. Committee on Science and Technology

On January 31, 1980, the Committee on Science and Technology held a hearing to receive testimony from the Department of Energy on its FY 1981 budget request. Mr. Charles W. Duncan, Jr., Secretary, Department of Energy, accompanied by Dr. John Deutch, Under Secretary, and Mr. John Hewitt, Chief Financial Officer, testified in support of the DOE authorization proposal of $8,732,230,000 submitted by the President for FY 1981.

B. Subcommittee on Energy Development and Applications

The Subcommittee on Energy Development and Applications held hearings on the DOE fossil, conservation and solar applications, and solar technology and biomass programs budget request for FY 1981 on February 5, 6, 12, 13, 19, 20, 21, 22, 26, 27, 28, 29 and March 4, 5, 10, 11, 12, 18, 19, 20, 1980.

DOE officials who testified included:

Dr. Thomas Stelson, Assistant Secretary, Conservation and Solar Energy

Dr. Maxine Savitz, Deputy Assistant Secretary for Conservation

Dr. Bennett Miller, Deputy Assistant Secretary for Solar Energy

Dr. Robert San Martin, Deputy Assistant Secretary for Field Operations and International Programs

Dr. Leslie Levine, Director, Office of Solar Applications in Industry

Dr. Maurice J. Katz, Director, Office of Solar Power Applications in Designs

Dr. Paul Maycock, Acting Director, Photovoltaic Systems Division

Mr. John Millhone, Director, Office of Buildings and Community Systems

Mr. Douglas Harvey, Director, Office of Industrial Systems

Mr. George Fumich, Assistant Secretary for Fossil Energy

Mr. Roger LeGassie, Principal Deputy Assistant Secretary for Fossil Energy

Dr. Ruth Davis, Assistant Secretary, Resource Applications

Mr. Larry Lukens, Acting Deputy Assistant Secretary for Industrial Planning and Development, Resource Applications

Mr. Donald Walter, Chief, Community Technology Systems Branch

Miss Charlotte Rines, Program Manager, Office of Commercialization

Dr. Frederick Morse, Acting Director, Office of Solar Applications for Buildings

In addition to DOE officials, testimony was also taken from the following Members of Congress:

Honorable Birch Bayh, Senator, (D–Ind.)

Honorable Mike McCormack, (D–WA)

Honorable John Dingell, (D–Mich.)

Honorable Floyd Fithian (D–Ind.)
Honorable Bill Bradley, Senator (D–N.J.)
Honorable Robert A. Roe (D–N.J.)
And the following citizens:
Mr. Dennis Costello, Solar Energy Research Institute
Mr. Michael Holtz, Solar Energy Research Institute
Mr. James J. Connolly, Chairman, Solar Thermal Energy Association
Mr. Ralph Wilham, General President, Sheet Metal Workers International Assoc.
Herbert R. Epstein, Solar Lobby.
S. David Freeman, Tennessee Valley Authority
Hon. James Conway, Mayor, St. Louis, Missouri
Hon. John Hutchinson, Mayor, Charleston, West Virginia
Mr. S. R. Hart, Jr. and William A. Wilson, Joint Venture Air Products/Wheelabrator-Frye
Richard Flynn, Vice President, Gulf Mineral Resources
Robert Rosenberg, Executive Vice President, Gas Research Institute
George Lawrence, President, American Gas Association
Mr. Frank Schora, Sr. Vice President, Institute Gas Technology
David Hansen, President, Memphis Light, Gas and Water Division
Thomas Gamble, Hercules, Inc.
Robert Meeker, Vice President, TRW
R. Stanley Baxter, Delphi American Corp.
John Day, III, Strategies Unlimited
Dr. Thomas Jaras, Science Applications, Inc.
Ladd M. Seaberg, Midwest Solvents, Inc.
Dr. Gene Goodson, Purdue University
Dr. Frank Graziano, Pre-Finished Metals
Dr. Robert Staffin, Procedyne Corporation
Dr. Charles Berg, Buckfield, Maine
Dr. Marc Ross, University of Michigan
Dr. Arthur Rosenfeld, Lawrence Livermore Laboratory
Dr. Dorothy Leonard-Barton, Stanford University
Dr. Samuel I. Doctors, University of Pittsburgh
Robert L. Judd, Jr., Governors Office, Sacramento, California
Don Patterson, American Agricultural Movement
Dr. Ralph Frederickson, Katzen Engineering
Dr. John Radovich, University of Oklahoma
Grant Thompson, Conservation Foundation
Dr. Lloyd Lawrence, Jr., Mechanical Technology, Inc.
Stan Barber, Purdue University
H. W. Scheld, Simco, Inc.
Charles Conway, Massachusetts Institute of Technology
Steven Morgan, New England Energy Congress
Jerry Birchfield, Georgia Institute of Technology
Mr. Dennis N. Horgan, Solar Energy Research Institute
Dr. James Abert, Vice President, National Center for Resource Recovery
Dr. John Gibbons, Director, Office of Technology Assessment
Mr. Douglas C. Hasbrouck, Director, Resource Development Bureau, N.Y. Energy Office

Mr. John Kehoe, Vice President, Wheelabrator-Frye, Inc.
Mr. Anthony Nollet, President, AENCO, Inc.
Mr. James A. Elsner, General Electric
Mr. Kenneth Ladd, Southwestern Public Service Company
Mr. D. L. Broussard, VP, Arizona Public Service Company
Dr. Alvin F. Hildebrandt, University of Houston
Mr. Harrison C. Wroton, Martin-Marietta Corp.
Mr. Byron Washom, ADVANCO Corp.
Mr. Peter deLeon, Science Applications, Inc.
Mr. Ralph Johnson, National Association of Home Builders
Dr. L. T. Papay, Southern California Edison Company
Dr. Donald A. Neeper, Los Alamos Scientific Laboratory
Professor Allan Krass, Hampshire College
Dr. Patrick J. Call, Solar Energy Research Institute
Dr. Charles A. Bankston, Los Alamos Scientific Laboratory
Father William Hogan, Fordham University
Mr. Jerry P. Davis, Thermo Electron Corporation.

'. *Subcommittee on Energy Research and Production*

The Subcommittee held hearings on the DOE budget request for FY
981 on February 5, 7, 12, 13, 19, 21, 26, 28, and March 3, 4 and 6, 1980.

Testimony on Nuclear Energy Programs was received from the fol-
owing DOE witnesses: Dr. George W. Cunningham, Assistant Secre-
ary for Nuclear Energy; Mr. Robert Ferguson, Deputy Assistant Sec-
etary for Nuclear Reactor Programs; Mr. Robert B. Staker, Director,
eactor Research and Technology Division; Dr. Ruth M. Davis, As-
istant Secretary for Resource Applications; Dr. Stanley I. Weiss,
eputy Assistant Secretary for Industrial and Utility Applications
nd Operations; Mr. William Voigt, Director, Office of Uranium Re-
ources and Enrichment; and Mr. Sheldon Meyers, Deputy Assistant
ecretary for Nuclear Waste Management.

The Subcommittee also heard testimony from the following non-
overnment witnesses concerning the Nuclear Energy Program: Mr.
ol Burstein, Executive Vice President, Wisconsin Electric Power
ompany; Mr. William McCollam, President, Edison Electric Insti-
ute; Dr. D. Clark Gibbs, Director, Nuclear Activities, Middle South
tilities, Inc.; Mr. Ralph M. Davis, Chairman, Helium Breeder Asso-
iates; Mr. Richard R. Walker, President, Public Service Company;
r. Robert B. Richards, General Manager, Advanced Reactor Systems
epartment, General Electric Company; Dr. Harold M. Agnew, Pres-
dent, General Atomic Company; and Dr. Donald Blickwede, Vice
resident, Research, Bethlehem Steel Corporation. Testimony on the
ivilian Nuclear Waste Management Program was received from: Dr.
arry L. Hench, Professor, Department of Materials Science and En-
ineering, University of Florida; Dr. Earnest F. Gloyna, Dean, Col-
ege of Engineering, University of Texas; and Dr. Lynn E. Weaver,
ice Chairman and Chairman Elect, Coordinating Committee on
nergy, Association for Cooperation in Engineering, and Director,
chool of Nuclear Engineering, Georgia Institute of Technology. The
ubcommittee also heard from D. L. J. Colby, Jr., Senior Vice Presi-
ent, Allied Chemical Corporation, and Dr. James A. Buckham, Ex-
cutive Vice President, Allied-General Nuclear Services, concerning
he Barnwell Nuclear Fuel Plant.

Testimony on Fusion Energy Programs was received from the following DOE witnesses: Dr. N. Douglas Pewitt, Deputy Director, Office of Energy Research; Mr. Edwin Kintner, Associate Director for Fusion Energy, Office of Energy Research; Dr. John Clarke, Deputy Associate Director for Fusion Energy, Office of Energy Research; Mr. Duane Sewell, Assistant Secretary for Defense Programs; Mr. Philip E. Coyle, Deputy Assistant Secretary for Defense Programs; and Dr. Richard Schriever, Deputy Director, Office of Inertial Fusion. The Subcommittee also heard testimony from the following non-Government witnesses on the Fusion Energy Programs: Dr. Stephen Dean, President, Fusion Power Associates; and Dr. Sibley C. Burnett, Manager, Fusion Program Development Department, General Atomic Company, and representing the Atomic Industrial Forum.

On the Geothermal Energy and Small Scale Hydropower Programs, the Subcommittee heard testimony from the following DOE witnesses: Dr. Ruth Davis, Assistant Secretary for Resource Applications; Dr. Stanley Weiss, Deputy Assistant Secretary, Industrial and Utility Applications and Operations; Mr. Rudy Black, Director, Office of Renewable Resources; Mr. Bennie DiBona, Director, Division of Geothermal Energy; and Mr. Falwell Smith, Acting Director, Small Scale Hydropower Programs.

The Subcommittee heard testimony on Electric Energy Systems and Energy Storage Systems from the following DOE witnesses: Dr. Ruth Davis, Assistant Secretary for Resource Applications, Dr. Stanley Weiss, Deputy Assistant Secretary, Industrial and Utility Applications and Operations; Dr. Fox Parry, Director, Electric Energy Systems; Dr. Thomas Stelson, Assistant Secretary for Conservation and Solar Energy; and Dr. George Pezdirtz, Director, Energy Storage Systems. Non-Government witnesses included: Mr. Larry S. Price, Engineer, and Dr. Thomas E. Michaels, Manager, Measurement Technology Department, Hanford Engineering Developmetal Laboatory; Mr. Peter S. VanNort, Senior Vice President, Wisconsin Power and Light; Dr. Roger W. Boom, Project Manager, Engineering Experiment Station, University of Wisconsin-Madison; and Mr. John A. Wright, Member, Board of Directors, Chairman, Electric Vehicle Committee, Lead Industries Association, and President, St. Joe Lead Corporation.

DOE witnesses on Basic Energy Sciences and High Energy and Nuclear Physics Programs were: Dr. Edward Frieman, Director, Office of Energy Research; Dr. James Kane, Associate Director, Basic Energy Sciences, Office of Energy Research; and Dr. James Leiss, Associate Director, High Energy and Nuclear Physics, Office of Energy Research.

The Subcommittee also heard testimony from representatives of the Engineers Public Affairs Forum on the DOE energy programs in general. These witnesses were: Dr. Robert B. Gaither, Professor and Chairman, Department of Mechanical Engineering, University of Florida; Dr. Thomas H. Lee, Staff Executive, Power Systems Technical Operations, General Electric Company; Dr. Lewis Conta, Engineer in Residence, Engineering Societies Commission on Energy; Dr. William H. Dresher, Dean of Mines, University of Arizona; and Mr. Edgar Pavia, P.E., President, Pavia-Byrne Engineering Corporation.

ubcommittee on Natural Resources and Environment

ı February 5, 1980, the Subcommittee held a hearing which Mrs.
h C. Clusen, Assistant Secretary for Environment presented
nony on the Department of Energy's program in the Office of
ironment. At hearings on February 6, two public witnesses tes-
l on aspects of the budget: Dr. Robert Moseley, M.D., Chairman,
ırtment of Radiology, University of New Mexico Medical School,
Mr. David Masselli, Friends of the Earth.

ubcommittee on Transportation, Aviation and Communications

ıe Subcommittee on Transportation, Aviation, and Communica-
; held program review hearings on October 10 and 11, 1979 and
get authorization hearings on February 12 and 13, 1980 on the
artment of Energy's Transportation Programs. The Subcom-
ee received testimony from the Department and from a variety
ıtside witnesses.

III. SUMMARY OF COMMITTEE ACTIONS

SUMMARY OF COMMITTEE ACTIONS

[In thousands of dollars]

	Fiscal year 1979 budget authority (actual)	Fiscal year 1980 budget authority (estimate)[1]	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE request (budget authority)[2]	Committee action	
					Changes to original authorization request	Total authorization
Nuclear fission:						
Operating expenses	864, 638	875, 687	634, 860	−4, 800	+251, 520	886, 380
Plant and capital equipment	192, 377	184, 633	110, 286		+33, 900	144, 186
Total, nuclear fission	1, 057, 015	1, 060, 320	745, 146	−4, 800	+285, 420	1, 030, 566
Jranium enrichment activities/advanced isotope separation technology:						
Operating expenses	928, 870	827, 213	975, 585	−46, 000	−37, 000	938, 585
Plant and capital equipment	337, 200	481, 405	552, 095	−190, 000	−342, 000	210, 095
Total, uranium enrichment/advanced isotope separation technology	1, 266, 070	1, 308, 618	1, 527, 680	−184, 485[3]	−379, 000	1, 148, 680
usion energy:						
Magnetic fusion:						
Operating expenses	215, 073	233, 105	286, 117	−5, 000	+12, 183	298, 300
Plant and capital equipment	140, 067	122, 300	209, 940	−2, 500	+30, 860	240, 800
Total, magnetic fusion	355, 140	355, 405	496, 057	−7, 500	+43, 043	539, 100
Inertial confinement fusion: civilian applications; operating expenses	0	0	0		+7, 500	7, 500
Total, fusion energy	355, 140	355, 405	496, 057	−7, 500	+50, 543	546, 600
ossil energy:						
Fossil energy, research and development:						
Operating expenses:						
Coal	535, 101	647, 393	592, 471	−31, 000	−5, 000	587, 471
Oil and gas	132, 865	94, 067	91, 609		+5, 000	96, 609
Total, operating expenses	667, 966	741, 460	684, 080	−31, 000	0	684, 080
Plant and capital equipment	105, 429	108, 850	641, 005	−4, 000	−257, 835	383, 170
Total, fossil research and development	773, 395	850, 310	1, 325, 085	−35, 000	−257, 835	1, 067, 250
Fossil energy, resource applications:						
Operating expenses	5, 575	13, 845	15, 087			15, 087
Plant and capital equipment	0	0	0		+3, 100	3, 100
Total, fossil resource applications	5, 575	13, 845	15, 087		+3, 100	18, 187
Total, fossil energy	778, 970	864, 155	1, 340, 172	−35, 000	−254, 735	1, 085, 437
ergy conservation:						
Operating expenses	286, 268	345, 037	420, 285	−25, 000	+35, 975	456, 260
Plant and capital equipment	3, 200	2, 600	4, 250			4, 250
Total, energy conservation	289, 468	347, 637	424, 535	−25, 000	+35, 975	460, 510

SUMMARY OF COMMITTEE ACTIONS—Continued

[In thousands of dollars]

	Fiscal year 1979 budget authority (actual)	Fiscal year 1980 budget authority (estimate)[1]	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE request (budget authority)[2]	Committee action: Changes to original authorization request	Committee action: Total authorization
lar applications:						
Operating expenses	126, 030	134, 591	176, 301	−20, 000	+9, 500	185, 801
Plant and capital equipment	1, 000	2, 000	2, 500			2, 500
Total, solar applications	127, 030	136, 591	178, 801	−20, 000	+9, 500	188, 301
lar technology:						
Operating expenses	301, 190	343, 653	414, 500		+53, 000	467, 500
Plant and capital equipment	63, 715	94, 335	50, 000	−9, 000	+5, 100	55, 100
Total, solar technology	364, 905	437, 988	464, 500	−9, 000	+58, 100	522, 600
othermal and hydroelectric energy:						
Operating expenses:						
Geothermal energy	142, 272	121, 712	141, 179		−20, 500	120, 679
Geothermal resources development fund	204	181	1, 284			1, 284
Small-scale hydropower	18, 627	8, 644	9, 000		−2, 000	7, 000
Total, operating expenses	161, 103	130, 537	151, 463		−22, 500	128, 963
Plant and capital equipment	14, 450	23, 650	12, 221		+8, 000	20, 221
Total, geothermal and hydroelectric energy	175, 553	154, 187	163, 684		−14, 500	149, 184
ctric energy systems and energy storage systems:						
Operating expenses	95, 046	100, 682	108, 523		+5, 000	113, 523
Plant and capital equipment	4, 100	2, 960	3, 200			3, 200
Total, electric energy systems and energy storage systems	99, 146	103, 642	111, 723		+5, 000	116, 723
vironment:[4]						
Operating expenses	234, 965	255, 750	286, 604	−22, 300	−22, 900	263, 704
Plant and capital equipment	23, 350	21, 300	23, 040			23, 040
Total, environment	285, 315	277, 050	309, 644	−22, 300	−22, 900	286, 744
pporting research:						
Operating expenses:						
Basic energy sciences	171, 170	195, 900	236, 544	−7, 000	−10, 700	225, 844
Technical assessment projects	10, 675	12, 966	21, 240	−5, 500	−3, 500	17, 740
University research support	6, 199	7, 067	14, 320	−3, 000	−6, 500	7, 820
Engineeirng traineeship program	0	0	0		+5, 000	5, 000
Technical program and policy analysis	1, 826	1, 935	1, 981			1, 981
Total, operating expenses	189, 870	217, 868	274, 085	−15, 500	−15, 700	258, 385
Plant and capital equipment:						
Basic energy sciences	31, 670	31, 000	23, 300	−1, 000	−7, 300	16, 000
Technical assessment projects	0	500	0			0
General purpose facilities	0	0	121, 400		−35, 450	85, 950
Total, plant and capital equipment	31, 670	31, 500	144, 700	−1, 000	−42, 750	101, 950
Total, support research	221, 540	249, 368	418, 785	−16, 500	−58, 450	360, 335
eral science and research:						
High energy physics:						
Operating expenses	194, 517	219, 589	242, 245		−4, 000	238, 245
Plant and capital equipment	102, 700	105, 500	305, 600	−4, 000	−146, 000	159, 600
Total, high energy physics	297, 217	325, 089	547, 845	−4, 000	−150, 000	397, 845
Nuclear physics:						
Operating expenses	74, 748	81, 574	88, 800			88, 800
Plant and capital equipment	17, 900	23, 000	44, 700	−4, 000	−21, 600	23, 100
Total, nuclear physics	92, 648	104, 574	133, 500	−4, 000	−21, 600	111, 900
Total, general science and research	389, 865	429, 663	681, 345	−8, 000	−171, 600	509, 745

SUMMARY OF COMMITTEE ACTIONS—Continued

[In thousands of dollars]

	Fiscal year 1979 budget authority (actual)	Fiscal year 1980 budget authority (estimate)[1]	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE request (budget authority)[2]	Committee action: Changes to original authorization request	Committee action: Total authorization
l administration:						
ig expenses	197,588	224,205	425,823	−9,000	−18,400	407,423
d capital equipment	29,260	36,015	101,465		−31,000	70,465
departmental administra-)	226,848	260,220	527,288	−9,000	−49,400	477,888
d development construc- icilities office	0	0	0		+400	400
	5,609,848	5,984,844	7,389,360	−341,585	−505,647	6,883,713
of unobligated balances ues:[5]						
enrichment activities	−1,232,957	−1,310,000				
	4,376,891	4,674,844	7,389,360	−341,585	−505,647	6,883,713

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ar 1980 budget authority excludes pending supplementals.

iscal year 1981 DOE request are changes to the original (January) fiscal year 1981 DOE request for budget

revised DOE request for uranium enrichment activities for fiscal year 1981 is −$233,000,000; the reduction 34,485,000) is the amount allowed DOE by law, due to return to the Treasury of excess revenues.

ent programs include: Overview and assessment and environmental research in the environment program; ices/nuclear medicine applications in the general science and research program.

ed balances and revenues are applied to the fiscal year budget authority in the uranium enrichment program partmental administration program. The estimated fiscal year 1981 revenues for fiscal year 1981 for departistration are $131,267,000; the estimated fiscal year 1981 revenues for fiscal year 1981 for uranium enriches are $1,289,045,000.

OMMITTEE ACTIONS REFLECTED IN THIS REPORT BASED ON THE ORIGINAL (JANUARY 1980) DOE GET REQUEST

LEAR FISSION AND URANIUM ENRICHMENT: SUMMARY OF COMMITTEE ACTIONS

A. OPERATING EXPENSES

entional Nuclear Systems (*Converter Reactors*)

Committee added $51.0 million to Thermal Reactor Tech- including: $46.5 million to International HTGR to establish R Lead Plant project, develop an HTGR program plan, conchnology development and to continue international cooperad $3.5 million to Thorium recycle R. & D.; $1.0 million to LWR Technology to develop a public information program and R. & he comparative risks of nuclear energy and health effects of n. It added $16.0 million to LWR Thermal Reactor Fuel Cycle including $7.0 million to continue development of the Sol-Gel and $9.0 million for the Barnwell Nuclear Fuel Plant to conesearch toward utilization of the Barnwell facility in a cong mode and optimization of nuclear safeguards system. The tee reduced Advanced Reactor Systems by $2.0 million.

an Waste Management

Committee decreased operating expenses by $42.5 million, in- a decrease of $33 million for Terminal Isolation R. & D., a decrease of $6 million for Waste Systems Evaluation and Public Interaction, and a decrease of $3.5 million for Waste Treatment Technology. The Committee included $5 million in title I for the West Valley, NY, Demonstration, which was originally included in Title V in the Administration's budget. The Committee moved to Title VII the following: $0.5 million for support studies, $2.0 million for site and repository licensing, and $0.9 million for low-level waste management operations. The Committee specified that the operating expenses will include $78.4 million for Site Exploration and Investigation Activities for preparations for high-level waste repositories, at least $9 million for Waste Technology and Canister Development, and at least $2.9 million for the Low Level Waste subprogram.

3. Advanced Nuclear Systems

The Committee reduced Space and Terrestrial Applications by $2.0 million because of budget constraints which will slow the development of power sources for the Solar-Polar Satellite project.

4. Breeder Reactor Systems

The Committee added $239.82 million to the Liquid Metal Fast Breeder Reactor program as follows:

$10.0 million increase for Fast Flux Test Facility to maintain full testing schedule;

$11.8 million increase for Test Facilities to maintain operation;

$155.0 million increase for Clinch River Breeder Reactor Project for continuation of the project, of which up to $15.0 million is for a Joint Plant Design Activity with the United Kingdom; and

$63.02 million increase for Breeder Technology to maintain a viable base program.

The Committee reduced Water Cooled Breeders by $19.8 million, including $14.8 million for Advanced Water Breeder Applications and $5.0 million for Light Water Breeder Reactors. It added $9.0 million for Fuel Cycle Research and Development to continue development of proliferation resistant and safe reprocessing of breeder fuel.

5. Uranium Resource Assessment

The Committee added $2 million to provide for a better characterization (on the basis of available information on resources) of a prudent planning base of resources for making critical nuclear energy policy decisions.

6. Uranium Enrichment

The Committee reduced operating expenses for Gaseous Diffusion Operations and Support by $43 million, eliminating funds for electric power demand charges. For Advanced Isotope Separation Technology, the Committee decreased authorization for assessing foreign technologies by $3 million and added $19 million to permit a new industrial partner to compete on an equal footing with the present DOE program.

B. PLANT AND CAPITAL EQUIPMENT

. Conventional Nuclear Systems (Converter Reactors)

The Committee added $7.0 million in capital equipment to Three Mile Island Examination Activities. It added $2.5 million in con-

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on funds to LWR Thermal Reactor Fuel Cycle R. & D. to nego- he purpose of the Barnwell Nuclear Fuel Plant (Project 04).

lian Waste Management

Committee added $0.5 million to the net authorization. The es and decreases are to be distributed as follows;

$1.7 million decrease in capital equipment for Terminal Isola- n R. & D.;

$6.8 million decrease for the Administration's proposed con- uction project 81-T-301-Salt Test Facility;

$6 million increase for Project 81-H—01-First Technology monstration Repository;

$2 million increase for Project 81-H-02-Second Technology monstration Repository; and

$1 million increase for Project 81-H-03-High-Level Waste lidification Demonstration Facility.

der Reactor Systems

Committee added $5.2 million in capital equipment to LMFBR r Technology. It increased construction project authorizations 7 million. The individual increases and decreases are as follows:

3.5 million decrease for Project 81-T-310, General Plant ojects;

10.0 million increase for Project 78-6-f, Fuels and Materials amination Facility;

1.0 million increase for Project 81-T-311, Support Services ilding;

0.8 million increase for Project 81-T-312, GPP-Test Reactor ea; and

7.4 million increase for Project 78-6-e, Liquid Metal Engineer- Center Modifications.

ium Enrichment

Committee reduced authorization for uranium enrichment by $300,600,000. The individual decreases are as follows:

111.6 million decrease for Project 71-1-f, Process Equipment difications, Gaseous Diffusion Plants.

170.0 million decrease for Project 76-8-g, Enriched Uranium duction Facilities, Portsmouth, Ohio.

19.0 million decrease for Project 81-R-506, Environmental tection and Safety Modifications, Phase I, Gaseous Diffusion nts.

FUSION ENERGY: SUMMARY OF COMMITTEE ACTIONS

A. OPERATING EXPENSES

ement Systems

ommittee transferred $4.5 million for modification of ISX-C nfinement Systems to Planning & Projects construction.

opment and Technology

ommittee increased authorization by $7.0 million for super- ng magnet research, poloidal field pulsed power development, neutral beam and RF heating research, and start of first wall, blanket and shield engineering work.

3. Planning and Projects

The Committee increased authorization by $2 million for MFTF and rescoped the project to a large tandem mirror experiment (MFTF-B). It authorized a new project, Fusion Engineering Test Facility with $6.0 million for conceptual design. The Committee increased by $1.5 million authorization for FMIT to relieve critical future funding requirements.

4. Inertial Confinement Fusion (Civilian Applications)

The Committee provided $6.0 million for Heavy Ion Beam research

B. PLANT AND CAPITAL EQUIPMENT

1. Confinement Systems

The Committee increased by $2 million capital equipment for TFTR diagnostics. It transferred from operating expenses $4.5 million for construction of ISX-C modifications (81-MF-2).

2. Development and Technology

The Committee increased by $1.5 million capital equipment for superconducting magnet research, neutral beam and RF heating facilities, and first wall-blanket and shield studies.

3. Planning and Projects

The Committee added $10.0 million in authorization ($4.0 million B/A) for Fusion Engineering Test Facility (81-MF-1) for Title I, site evaluation and selection. It added $6 million in B/A for MFTF to proceed with modification to MFTB tandem mirror. The Committee added $1.5 million for capital equipment for FMIT. An additional $0.2 million was added to begin renovation of the Fusion Research Building (81-MF-3). A $1 million decrease in GPP funding was authorized by the Committee.

4. Inertial Confinement Fusion (Civilian Applications)

The Committee authorized $1.5 million in capital equipment for Heavy Ion Beams.

Fossil Energy: Summary of Committee Actions

The Committee authorized a total of $932,671,000 for fossil energy research, development and demonstration programs, which is $262,835,000 below the President's January request. The Committee also authorized $18,187,000 for the fossil energy production, demonstration and distribution program, an increase of $3,100,000 above the request.

A. OPERATING EXPENSES

In several specific sub-programs, the Committee acted as follows:

1. *Mining R. & D.*—Increased by $7 million for advanced longwall mining, underground haulage systems, and anthracite open pit mine design.
2. *Coal Preparation R. & D.*—Decreased by $1 million from chemical coal cleaning.

3. *Coal Liquefaction.*—Added $3 million materials and component development and redirected $5 million for indirect liquefaction.

4. *Surface Coal Gasification.*—Decreased Third Generation Processes by $2 million for hydro-gasification and by $6 million for catalytic gasification.

5. *Advanced Research and Technology Development.*—Increased by $3 million for dry coal feeder technology.

6. *Advanced Environmental Control Technology.*—Decreased by $5 million for flue gas cleanup.

7. *Heat Engines and Heat Recovery.*—Increased by $2.5 million for coal fired cogeneration demonstration.

8. *Combustion Systems.*—Decreased by $18,500,000 by decreasing coal-oil mixtures by $18 million by decreasing the Rivesville AFB pilot plant by $3 million, and by adding $2.5 million for innovative retrofit coal combustor for industrial boilers.

9. *Fuel Cells.*—Increased by $12 million for on-site cogeneration applications and electric utility applications.

10. *Enhanced Oil Recovery.*—Increased by $5 million for data collection, analysis activities, and basic research in micellar polymer recovery technology.

B. PLANT AND CAPITAL EQUIPMENT

1. *Coal Liquefaction.*—Decrease of $95 million. Decreased by $45 million from SRC–I and by $50 million from SRC–II.

2. *Surface Coal Gasification.*—Decrease of $150 million. Decreased by $188 million from the First High-Btu Pipeline Demonstration project and increased by $38 million to the Second High-Btu Pipeline Demonstration project.

3. *Advanced Research and Supporting Technology.*—Decreased by $9,900,000 from various plant projects at the Energy Technology Centers.

4. *Combustion Systems.*—Decrease of $2,935,000. Added $10,000,000 for Industrial AFB Demonstration projects, decreased by $19,935,000 for the AFB–CTIU thereby terminating the project, and transferred $7 million from operating expenses for coal-oil mixture demonstration projects.

5. *Fossil Production, Demonstration, and Distribution.*—Increased by $3,100,000 for a peat combustion project.

Conservation: Summary of Committee Action

OPERATING EXPENSES

The Administration requested $424,535,000 for conservation; the Committee increased this by $351,975 as follows:

1. *Buildings and Community Systems.*—increased by $42.8 million for buildings conservation demonstrations, waste to energy demonstrations, conservation marketing, district heating and market research.

2. *Industrial Energy Conservation.*—increased by $50 million for waste energy reduction, industrial process efficiency, industrial cogeneration, and implementation and deployment and a long-term applied research and education plan.

3. *Transportation Conservation.*—increased by $9 million for alternative fuel utilization, the electric and hybrid vehicle program and the vehicle propulsion R&D effort.

4. *Energy Management Partnership Act.*—decreased by $73.825 million to defer authorization of new initiatives until consideration of the EMPA bill, and to require cost sharing in the Energy Extension Service.

5. *Conservation Multi-Sector.*—increased by $8.0 million to expand the Appropriate Technology program ($6.0 million), and develop a capability for in-house planning, analysis and evaluation ($2 million).

6. *Hybrid Buildings.*—redirected $2.515 million from Building Systems to the Hybrid Buildings program in Solar Applications.

SOLAR APPLICATIONS: SUMMARY OF COMMITTEE ACTIONS

The Administration requested $178,801,000 for Solar Applications including $2.5 million for capital equipment. The Committee increased the operating expenses by $9,500,000.

1. *Systems Development.*—increases of $5 million for passive solar product development, $4 million for Solar Pond research and development, $3 million for active and passive materials research and a decrease of $2 million in the Solar Cities activity.

2. *Market Test and Applications.*—increases of $2 million for solar enhanced oil recovery and $10 million for Federal Photovoltaic Utilization Program and a decrease of $25 million from photovoltaic multiyear buys; and $5 million for a hybrid buildings program for commercial and multifamily hybrid buildings; increase of $0.5 million for a conservation/solar buildings analysis.

3. *Market Development and Training.*—increase of $7 million for information, education and training programs with $1 million set aside for a report on DOE outreach programs including the Regional Solar Energy Centers.

SOLAR TECHNOLOGY: SUMMARY OF COMMITTEE ACTIONS

The Committee authorized a total of $522,600,00 for solar technology research, development and demonstration programs, which is $58,100,000 above the President's January budget request for fiscal year 1981.

A. OPERATING EXPENSES

The Committee acted on the following sub-programs:

1. *Solar Thermal.*—Increased by $18 million for utility/industrial repowering projects and development of a Stirling point focus heat engine.

2. *Photovoltaics.*—Increased by $15 million for the advanced silicon pilot plant, the Low-Cost Silicon Array project, and balance of systems cost reduction and decreased by $6 million from advanced research and development.

3. *Wind.*—The actions taken include both increases and decreases which result in a net increase of $1 million. The specific actions include:

$4.5 million increase for wind resource assessment;

$5 million increase for product improved 8 and 40 kilowatt machines;

$7 million transfer from operating expenses to plant and capital for the MOD–5 and MOD–6 wind turbines;

$1 million decrease in second generation small machine development; and

$500,000 decrease for innovative concepts.

4. *Ocean Systems.*—Increased by $6 million to restore funding for OTEC research and development activities.

5. *Solar International.*—Increased by $12 million to initiate an International Photovoltaic Program.

6. *Biomass.*—Increased by $2 million for research and development activities and redirected $3 million for a comprehensive program management plan.

7. *Office of Alcohol Fuels.*—Increased by $5 million for advanced fermentation systems.

B. PLANT AND CAPITAL EQUIPMENT

1. *Solar Thermal.*—Decreased solar industrial cogeneration projects by $1.9 million.

2. *Biomass.*—Decreased by $2 million for the Biomass Thermochemical Gasification Experimental Facility, Project No. 80–B–1.

3. *Wind.*—Increased by $12 million for the development of intermediate and large wind turbines. This action reflects a $7 million transfer of funds from operating expenses and the addition of $5 million.

GEOTHERMAL ENERGY AND SMALL-SCALE HYDROPOWER PROGRAM: SUMMARY OF COMMITTEE ACTIONS

OPERATING EXPENSES AND PLANT AND CAPITAL EQUIPMENT

1. Geothermal Energy

The Committee decreased the Administration's request of $154.684 million for geothermal energy by $12.5 million leaving a total authorization and recommended budget authority level of $141.911 million. Within this amount, the Committee directed that $10.0 million be used for continuing the second 50 MW Demonstration facility which was not part of the Administration's request.

2. Small Scale Hydropower Program

The Committee decreased the Administration's request of $9.0 million by $2.0 million leaving a total authorization and recommended budget authority level of $7.0 million.

ELECTRIC ENERGY SYSTEMS AND ENERGY STORAGE SYSTEMS: SUMMARY OF COMMITTEE ACTIONS

OPERATING EXPENSES

1. Electric Energy Systems

The Committee left unchanged the Administration's request for authorization for Electric Energy Systems.

2. Energy Storage Systems

The Committee increased the Thermal Storage subprogram by $1.5 million, the Chemical/Hydrogen subprogram by $2.1 million, and the Magnetic Storage subprogram by $1.4 million.

ENVIRONMENT: SUMMARY OF COMMITTEE ACTIONS

OPERATING EXPENSES

The Committee reduced the revised budget request by $600,000. This was a net of three changes: The Overview and Assessment Program was reduced by $700,000. The Environmental Research Program was increased by $3,100,000. The Life Sciences Research Program was reduced by $3,000,000.

SUPPORTING RESEARCH PROGRAMS: SUMMARY OF COMMITTEE ACTIONS

A. OPERATING EXPENSES

1. Basic Energy Sciences

The Committee decreased operating expenses by $10.7 million. The reductions in the subprograms are as follows:

	Millions
Nuclear science	$1.0
Materials sciences	2.6
Chemical sciences	3.1
Engineering, mathematical and geosciences	2.5
Advanced energy projects	0.9
Biological energy research	0.6

2. Technical Assessment Projects

The Committee decreased Assessment Projects by $0.5 million and Advanced Technology Projects by $3.0 million.

3. University Research Support

The Committee decreased University Institutional Agreements by $5.4 million, the University/Laboratory Cooperative Program by $0.6 million, and University Reactor Fuel Assistance by $0.5 million.

4. Engineering Traineeship Program

The Committee authorized a new line item, the Engineering Traineeship Program, with operating expenses of $5.0 million for FY 1981.

B. PLANT AND CAPITAL EQUIPMENT

1. Basic Energy Sciences

The Committee decreased capital equipment by $1.0 million. The Committee decreased the authorization by $6.3 million for Project 80-ES-10, Chemical and Materials Sciences Laboratory, Lawrence Berkeley Laboratory.

GENERAL SCIENCE AND RESEARCH: SUMMARY OF COMMITTEE ACTIONS

A. OPERATING EXPENSES

1. High Energy Physics

The Committee decreased Facility Operations by $2.0 million and High Energy Physics Technology by $2.0 million.

2. Nuclear Physics

The Committee left unchanged the Administration's request for Nuclear Physics operating expenses.

B. PLANT AND CAPITAL EQUIPMENT

1. High Energy Physics

The Committee decreased capital equipment by $2.0 million. The Committee decreased authorization by $27.0 million for Project 81–E–218, Tevatron, Phase 1, Fermi National Accelerator Laboratory. The Committee decreased authorization by $131.5 million for Project 78–10–b, Intersecting Storage Accelerator (ISABELLE), Brookhaven National Laboratory.

2. Nuclear Physics

The Committee decreased authorization by $6.5 million for Project 81–E–233, Argonne Tandem-linac Accelerator System (ATLAS), Argonne National Laboratory. The Committee decreased authorization by $15.1 million for Project 80–GS–5, National Superconducting Cyclotron Laboratory, Michigan State University.

DEPARTMENTAL ADMINISTRATION PROGRAMS: SUMMARY OF COMMITTEE ACTIONS

A. OPERATING EXPENSES

1. Policy Analysis and Systems Studies

The Committee decreased operating expenses by $5.4 million.

2. International Affairs

The Committee decreased operating expenses by $1.0 million as follows: reduction of $100,000 in International Cooperation in Non-nuclear Technologies; reduction of $900,000 in International Policy Studies.

3. Management and Support

The Committee decreased operating expenses by $7.5 million as follows: reduction of $2.5 million in Salaries and Expenses; reduction of $5.0 million in Support Services.

4. Intergovernmental and Institutional Relations

The Committee decreased operating expenses by $2.5 million.

5. Security Investigations

The Committee decreased operating expenses by $2.0 million.

B. PLANT AND CAPITAL EQUIPMENT

1. In-House Energy Management

The Committee decreased the authorization by $31.0 million for project 80-DA-6, Alternate Energy Source, Pantex Plant, Amarillo, Tex.

IV. EXPLANATION OF THE PROGRAMS CONTAINED IN H.R. 6627

A. Nuclear Fission and Uranium Enrichment Activities

1. CONVENTIONAL NUCLEAR SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Thermal reactor technology	98,000	46,500		+67,000	113,500
Advanced reactor systems	4,700	4,800	−2,000	−2,000	2,800
Subtotal, operating expenses	73,700	51,300	−2,000	+65,000	116,300
Program direction	1,298	1,465			1,465
Subtotal	74,990	52,765	−2,000	+65,000	117,765
Capital equipment:					
Thermal reactor technology	500	3,000		+7,000	10,000
Advanced reactor systems	300	200			200
Subtotal, capital equipment	800	3,200		+7,000	10,200
Construction:					
Authorization	0	0		+2,500	2,500
Budget authority	0	0		+2,500	2,500
Total authorization		55,965	−2,000	+74,500	130,465
Total budget authority	104,790	55,965	−2,000	+74,500	130,465

[1] Indicates changes to original fiscal year 1981 B/A request.

(a) THERMAL REACTOR TECHNOLOGY

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Light water reactor technology	49,500	46,500		+1,000	47,500
LWR fuel cycle R. & D	8,000	0		+7,000	7,000
Barnwell facility	11,500	0		+9,000	9,000
International HTGR	25,000	0		+46,500	46,500
HTGR thorium recycle	4,000	0		+3,500	3,500
Subtotal, operating expense	98,000	46,500		+67,000	113,500
Program direction	1,298	1,465			1,465
Subtotal	99,298	47,965		+67,000	114,965

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Capital equipment:					
Light water reactor technology	500	3, 000		+7, 000	10, 000
LWR fuel cycle R. & D	0	0			0
Barnwell facility	0	0			0
International HTGR	0	0			0
HTGR thorium recycle	0	0			0
Subtotal, capital equipment	500	3, 000		+7, 000	10, 000
Construction:					
Authorization	0	0		+2, 500	0
Budget authority	0	0		+2, 500	0
Total authorization		50, 965		+76, 500	124, 965
Total budget authority	99, 798	50, 965		+76, 500	124, 965

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

The Thermal Reactor Technology Program develops and demonstrates advanced technology for use in commercial Light Water Reactors (LWR's), and in advanced gas cooled reactor systems. Technologies are being developed for improving uranium utilization in once-through (non-reprocessing) LWR's, for reducing radiation exposure to nuclear plant personnel, for resolving critical technical problems that potentially can cause plant productivity to deteriorate, for enhancing the safety of nuclear plants, and for developing direct cycle and process heat base technology. LWR's provide a significant share of the U.S. electrical power needs now and will continue to do so in the years ahead. The technologies developed in this program will be of significant value in ensuring that thermal reactors play the important role expected of them in helping to meet the Nation's energy requirements.

(1) LIGHT WATER REACTOR TECHNOLOGY

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Uranium utilization	18, 000	21, 000			21, 000
Occupational exposqre	3, 000	10, 000			10, 000
LWR safety	3, 500	8, 000		+1, 000	9, 000
TMI activities	0	7, 500			7, 500
Subtotal, operating expenses	24, 500	46, 500		+1, 000	47, 500
Program direction	1, 298	1, 465			1, 465
Subtotal	25, 798	47, 965		+1, 000	48, 965
Capital equipment:					
Uranium utilization	0	0			0
Occupational exposure	0	0			0
LWR safety	500	2, 000			2, 000
TMI activities	0	1, 000		+7, 000	8, 000
Subtotal, capital equipment	500	3, 000		+7, 000	10, 000
Total	26, 298	50, 965		+8, 000	+58, 965

[1] Indicates changes to original fiscal year 1981 B/A request.

ıninum Utilization

ʀecent studies have shown that there is a significant potential for
reasing the efficiency of uranium utilization of LWRs. The tech-
ogy to achieve a 15 percent savings in uranium may be possible
hin the next 10 years—and an additional 15 percent savings may
possible by the year 2000. It is expected that most of these im-
vements could be retrofitted to current-design LWRs.

n view of the substantial uranium savings to be gained, the De-
tment of Energy has undertaken a high priority effort to develop
nium utilization improvements. The goal of this effort is to sup-
t projects for the rapid development and demonstration of im-
vements, which could lead to utility implementation in commer-
LWRs without delay.

ectives

'he objectives of the uranium utilization program elements are to
elop and demonstrate near-term improvements to LWR fuel and
l management practices that have the potential of reducing
nium consumption in existing LWRs by as much as 15 percent by
8, and longer-term improvements that have the potential of
ıcing uranium consumption of LWRs by an additional 15 per-
by 2000.

ıtegy and scope

s in other elements of the Thermal Reactor Technology Pro-
n, the uranium utilization projects are implemented by select-
electric utilities as prime contractors and fuel suppliers as sub-
ractors to the utilities. The utilities are teamed with fuel sup-
rs that normally provide fuel, engineering, safety analysis, and
ısing support. In this way, warranty agreements and other com-
cial arrangements affected by the demonstration fuel can be ac-
modated in the fuel supply contracts between the utility and the
lor.

us, Current Activities, and Participants

ı the Duke Power project, five fuel assemblies fabricated by
cock and Wilcox that were due to be disposed of as spent fuel in
ember 1978 were examined, reloaded, and burned an extra ir-
ation cycle in the Oconee-1 reactor. Four of the five assemblies
hed burnups of 40,000 megawatt days per metric ton (MWD/T)—
beyond the target goal of 38,000 MWD/T. The five assem-
were discharged in late 1979, and their performance is being
ıated. Similar projects involving Virginia Electric and Power,
ıha Public Power District, and Consumers Power Company for
fabricated by Westinghouse, Combustion Engineering, and Ex-
Nuclear, respectively, have been initiated. (At present, nuclear
is discharged from a typical LWR after it has achieved an aver-
ɔurnup of 25,000 to 33,000 MWD/T).

COMMITTEE ACTION

Uranium Utilization—no change.

Occupational Exposure Reduction/Productivity Enhancement.

Objectives

The objectives of this program element are to demonstrate the technology to reduce the occupational radiation exposure to LWR plant personnel and to increase nuclear plant productivity.

Strategy and Scope

The strategy being used for achieving these objectives is similar to that described above for other elements of the LWR technology program.

Progress towards achieving the occupational radiation dose reduction objective is being made through (a) projects to develop and demonstrate chemical processes to decontaminate reactor systems and reduce the radiation fields, (b) projects to develop and demonstrate surveillance and diagnostic techniques capable of replacing many currently required manual operations, thereby reducing the need for worker entry into radiation areas, and (c) other means being identified through studies for that purpose.

Work on productivity improvement includes developing ways of alleviating the effect of "denting" in pressurized water reactor (PWR) steam generators, a problem causing extended outages in nuclear power plants, and ways of preventing component failures arising from flow induced vibration.

Status, Current Activities, and Participants

Projects are under way to develop chemical decontamination techniques for removal of radioactive deposits from reactor primary systems and to alleviate "denting" with Commonwealth Edison. General Electric and Argonne National Laboratory are the contractors for flow induced vibration projects.

COMMITTEE ACTION

Occupational Exposure Reduction/Productivity Enhancement—No change.

LWR Safety

Objective

The objective of this activity is to improve the safety of light water reactors. Primary emphasis of the work is to improve safety through the prevention of reactor plant accidents. The work is categorized in four major areas of interest having detailed objectives as follows:

Improved systems.—To develop advanced concepts to improve existing designs and plant layouts so that plants can meet existing and new safety requirements more effectively, reliably, and economically.

Man-machine interface.—To investigate the man-machine interface to improve safety in the control of normal operations, includ-

g fuel handling and maintenance, and in operator response
ring transients and emergency situations and during the early
ases of accident sequences.

Risk-methods utilization.—To develop and use risk-based meth-
s and studies to: (a) establish R&D priorities by focusing atten-
n on sensitive systems, components, and processes, (b) reduce
k through design and operations changes, and (c) assess the rel-
ve value and importance of required and proposed plant safety
difications.

Safety data.—To accumulate and analyze safety data to deter-
ne needs for plant improvements and help resolve generic safety
ues.

y and Scope

epts and systems to improve safety are being developed for im-
tation in LWRs. Potential areas have been defined through dis-
s with the NRC, the nuclear industry, national laboratories, and
rs of the technical community. Particular emphasis will be
on safety needs derived from the TMI-2 experience.

nd Current Activities

planning of this subprogram was initiated in fiscal year 1978.
Laboratories was selected as technical manager. During fiscal
79, work was initiated in all four of the subprograms. Principal
ment and demonstration activities, particularly those directed
systems development and testing, will be performed by indus-
h support activities provided by national laboratories, universi-
small engineering R&D organizations, as appropriate.

COMMITTEE ACTION

afety—$1 million increase

ommittee authorized additional funding of $1.0 million for the
ment of Energy to provide for a public information program
risks of nuclear power plants as compared to other means of
al energy production and on the health effects of radiation.
Committee believes that a public informed on the comparative
electrical energy production systems can better understand and
ctively participate in the decision making process for the selec-
energy production systems. The Committee notes that the in-
on program should encompass the complete fuel cycle for each
l energy production system.

Secretary should utilize public and professional workshops
tings in addition to the media to inform the public of the risks
ed with nuclear power plants as compared to other forms of
including the health effects of radiation. The use of recognized
from outside the DOE is encouraged.

ile Island Activities

w

DOE is involved in two activities that respond to needs that
from the Three Mile Island (TMI) accident. One is a program

for post-accident examination of TMI Unit 2 to gather information that will be useful in improving the safety of nuclear power plants. The other program is intended to increase the DOE's emergency response capability.

The Three Mile Island Information and Examination program will obtain data from examination and evaluation of the damaged TMI plant and equipment that will be of significant value for improving the safety of light water reactor plants, improving the capablity to safely clean up from any civilian nuclear plant accident, and applying the lessons learned on how the country can be better prepared to respond to any accident in the future.

The DOE's Emergency Response Capability includes the Nuclear Emergency Search Team and the Aerial Measuring System which have the capability for on-scene management of emergency operations. An additional Nuclear Emergency Search Team to be located in the eastern U.S. is intended to augment present technical support based in the western United States.

Three Mile Island Information and Examination

On March 28, 1979 the TMI–2 nuclear plant suffered an accident which is considered the most serious mishap to date in a commercial nuclear power plant. Although there was great damage to the nuclear reactor core, the escape of radiation from the containment was mostly radioactive gas which had an insignificant impact on the health and safety of the public.

One of the specific recommendations of the President's Commission (Kemeny Commission) on the Accident at TMI was that further efforts should be made to increase understanding of the event. The President directed the DOE to undertake this program. The TMI Information and Examination Program will obtain, analyze and evaluate information from the examination of the TMI–2 plant and make this information available for the general improvement of light water reactor plant safety and reliability.

Objectives

The objectives of the TMI Information and Examination Program are:

To develop and make available significant information for the general improvement of nuclear plant safety by careful examination of the results of the TMI–2 accident, and

To improve the capability for the safe recovery of civilian nuclear power plants from accidents and for their restoration to service.

Strategy and Scope

During fiscal year 1981, the program will focus on detailed examination of equipment and samples removed from the plant and on testing of advanced radioactivity cleanup and disposal methods. Special in-situ examination of the reactor primary system and reactor internals will be initiated. The program will be completed several years after core removal, which will probably take place in fiscal year 1982 or 1983. The latter stages of the program will emphasize laboratory nination of fuel and core specimens to aid in the understanding ie accident.

ajor tasks and areas of TMI Information and Examination Pro- 1 activities are: Instrumentation and Electrical Equipment Sur- bility, Radiation and Environment; Radioactive Waste Handling; sical Plant Examination; Data Storage and Integration; Mechani- ind Structure Components; and Reactor Core and Fuel.

us and Current Activities

ie Three Mile Island Information and Examination Program will itiated about mid-year in fiscal year 1980, based upon plans devel- by a joint coordinating group that includes the Nuclear Regula- Commission, the Electric Power Research Institute, and the Gen- Public Utilities Corporation, as well as the DOE.

ie goal is to acquire data and information from the damaged TMI t and reactor that will aid in understanding the accident and there- ssist industry and the Nuclear Regulatory Commission in making ovements to help prevent such accidents in the future, and to miti- the consequences of any accidents that might occur.

COMMITTEE ACTION

e Mile Island Activities—$7.0 million increase

ie Committee authorized funding of $7.0 million to enhance the 's Emergency Response Capability based on the lessons learned ig and after the TMI accident. No funding was included in the inistration's proposed budget for this activity.

ie Committee intends to make available the full range of DOE's atory and test equipment capabilities in response to any future ar power accident, thus providing maximum assurance of the ic health and safety.

formalize an emergency support capacity, a Nuclear Emergency ch Team (NEST) in the eastern U.S. will provide capability for l deployment of experts, communication and test equipment to ite of the accident to assure the public health and safety during future nuclear power reactor incident. The recommended equip- additions address the following functional areas: On-Scene DOE mand Post Operations; Communications (voice, data, video, and lite links); Health Physics Support; Meteorology Advisory Sup- and Training and Exercises.

ere exists within the DOE an extensive emergency response capa- , managed by the Nevada Operations Office, utilizing resources iwrence Livermore Laboratory, Los Alamos Scientific Labora- Sandia, and EG&G. The personnel from these organizations are ally engaged on other programs which maintain their special ex- se. Six C-141 military cargo aircraft payloads of emergency re- e equipment located in Nevada are prepackaged for immediate yment by the Nuclear Emergency Search Team (NEST). The T team and the DOE Aerial Measuring System staff have demon- d concepts and techniques for on-scene management of emer- operations which have been both timely and effective. The addi- l Nuclear Emergency Search Team on the East Coast will augment the present emergency response capability to respond to any future power reactor incident and assure the public health and safety.

(2) Light Water Reactor Fuel Cycle R&D

Objectives

Reprocessing of LWR spent fuel is a necessary precursor to breeder reactor deployment. In addition, the development of sol-gel conversion and refabrication technology promises process improvement not only from a technical standpoint but also from its nonproliferation attributes. The LWR fuel cycle program provides for a continuation of these activities during FY 1981 such that further development decisions can be made at a time consistent with breeder reactor development.

Strategy and Scope

Program scope includes reprocessing and refabrication and the development of sol-gel technology for producing fuel particles which can be used either as a new fuel form or as feed for pelletizing operations.

Status and Current Activities

This technology is currently receiving attention in Europe as well as from U.S. fuel vendors. It offers advantages in simplifying the fabrication of nuclear fuels by alleviating problems associated with powders. Furthermore, accountability problems due to powder holdup will be reduced thus aiding in detection of any diversion attempts, a key nonproliferation attribute. This technology also has potential application for breeder fuels as well. The reprocessing and refabrication subprogram also provides for continued assessment of technical problems associated with alternative methods for LWR fuel reprocessing (that is, coprocessing) and for development of appropriate technology to resolve these problems. This subprogram will be developed in conjunction with activities in Breeder Fuel Cycle R&D.

COMMITTEE ACTION

Light Water Reactor Fuel Cycle R&D—$7 million increase

The LWR fuel cycle program was not included in the FY 1981 DOE request. The committee action restores work in coprocessing and refabrication and complements the breeder fuel cycle efforts. The program incorporates nonproliferation considerations for alternate fuel cycles and goes hand-in-hand with retention of the option for using the Barnwell plant as an international reprocessing facility.

(3) Support for the Barnwell Nuclear Fuel Plant (BNFP)

Under contract with the Department of Energy, Allied-General Nuclear Services has carried out a program of research and development at the Barnwell Plant in support of the Government's nonproliferation objectives. Results of this work will be of benefit to the nation whether spent fuel is ultimately to be reprocessed and recycled or disposed of as waste.

In carrying out this program, developments in several areas have been achieved.

In the area of nuclear safeguards, what may be the most sophisticated nuclear safeguards system in the world has been developed. That system is being used for safeguards training under provisions of the Nuclear Non-Proliferation Act of 1978. Barnwell can continue to be a valuable training center and testing system for future advanced safeguards hardware.

In the area of proliferation resistant fuel cycles, more proliferation resistant nuclear fuel cycles have been studied. Out of these studies have come recommendations that involve treating or "spiking" plutonium to make it more proliferation proof and blending plutonium with uranium to make its diversion for weapons use more unattractive. This work has provided valuable contributions to the International Nuclear Fuel Cycle Evaluation (INFCE).

In the area of spent fuel transportation and storage, studies conducted at Barnwell will result in improved techniques for transporting, handling and storing spent nuclear fuel. With the Presidential deferral of reprocessing and the resultant increase in the need for spent fuel storage, it is essential that new and more improved methods of spent fuel handling and storage be developed.

COMMITTEE ACTION

Support for the Barnwell Nuclear Fuel Plant—$11.5 million increase

This activity was not included in the fiscal year 1981 DOE request. The Committee added $9 million in operating funds which restores work in the BNFP support program and provides for the continued support of the Barnwell plant as a potential resource for reprocessing spent LWR fuel in the future. This support is necessary to retain the reprocessing option until the results of INFCE and NASAP can be assessed and their impacts registered in U.S. nuclear policy. Activities include examination of fuel cycle alternatives, evaluation of spent fuel storage and transportation problems, and testing of advanced safeguards concepts.

The Committee provided $2.5 million under Plant and Capital Equipment in Title VII for negotiations with the owners of the Barnwell Nuclear Fuel plant at Barnwell, South Carolina. One of the purposes of the negotiations is to obtain use of the spent fuel storage pool at this plant for use as an Away-From Reactor (AFR) storage facility, either by lease of the pool and the necessary associated buildings and land, or by purchase. The Committee included negotiations for the purchase of the entire facility in order to additionally enable R&D on nuclear safeguards.

(4) International High Temperature Gas-Cooled Reactor

The International High Temperature Gas-Cooled Reactor (HTGR) program currently includes plant design activities and technology development for near-term (~850°C) and longer-term (~950°C) applications of HTGR technology. These systems have important potential for supplying high temperature nuclear heat for the production of synthetic gas for use as a storable/transportable fuel substitute or directly as feedstock for various chemical processes, including the production of hydrogen, synthetic fuels, ammonia and methanol, for peaking electric power, process steam, or direct process heat use as well as electric power generation using high efficiency direct cycle gas turbines. Similar HTGR development programs are being pursued in the Federal Republic of Germany and in the United States, making international cooperation in this area both practical and economically desirable. The international agreement to facilitate these efforts, which was initiated in 1977, should be restructured and strengthened where possible to further enhance the effectiveness of the cooperation. The program will continue the onging fuels and materials technology, and special components and systems development activities to maintain as viable options all of the unique applications which are most suitable for these reactors.

COMMITTEE ACTION

International HTGR—$46.5 million increase

This activity was not included in the FY 1981 Department of Energy request. The Committee has authorized the continuation of this program and for the establishment of a High Temperature Gas Cooled Reactor (HTGR) lead plant project to focus the continuing generic HTGR technology R&D program. It allows for a serious gesture to the Federal Republic of Germany that the United States will be a strong partner in technology development of very high temperature reactors. The Lead Plant Project shall encourage commercial participation and support for the purpose of establishing the program and reducing or eliminating government support for the actual construction of the lead plant facility. The Lead Plant Project should include the preparation of a project decision package to be used as a basis for initial project commitment by the U.S. utility industry and the definition of the long-term program. The focus of the current program is on the Brayton direct cycle.

The generic HTGR technology program will continue in order to provide the base technology required for any HTGR application, but focused to support the Lead Project. The generic HTGR technology program will continue development of proliferation-resistant fuel, high temperature materials, safety and reliability analysis, and Pre-Stressed Concrete Reactor Vessel technology. The U.S. Lead Plant effort should proceed on the basis of a plant start-up in the mid-1900's, depending on the HTGR concept selection work during fiscal year 1980.

(5) HTGR Thorium Recycle

Although the current Administration has made the policy statement that the high temperature gas cooled reactor is not a likely option in this country, the Committee believes this decision is premature and contrary to the most informed views offered this subcommittee by the technical community. The Administration's fiscal year 1981 Department of Energy budget reflects an intention to terminate the ongoing HTGR recycle program at the General Atomic Company in San Diego, where a pilot recycle plant is in operation.

COMMITTEE ACTION

HTGR Thorium Recycle—$3.5 million increase

This activity was not included in the FY 1981 Department of Energy request. Although the current Administration has made the policy statement that light water reactor and high temperature gas cooled reactor fuel will not be reprocessed or refabricated in this country, the Committee believes this decision is premature and contrary to the most informed views offered this Committee by the technical community. The committee action restores thorium recycle work at less than half the FY 1979 funding level and nearly $1 million less than the FY 1980 level. The program will complement the refabrication activity in LWR fuel cycles. This sustaining effort should retain the option for reprocessing of fuels from advanced converter reactors. This minimum level will retain U.S. programs at both ORNL and GA which contribute to the joint U.S./Federal Republic of Germany cooperative recycle development program, which was created to take advantage of complementary national goals and offer the opportunity for more cost effective research by eliminating duplication of effort by use of joint facilities.

(b) ADVANCED REACTOR SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses: Advanced reactor systems	4,700	4,800	−2,000	−2,000	2,800
Capital equipment: Advanced reactor systems	300	200			200
Total	5,000	5,000	−2,000	−2,000	3,000

[1] Indicates changes to original fiscal year 1981 B/A request.

Research reactors are used throughout the world for a variety of beneficial purposes related to energy development, medicine, industrial processes, and basic research. They range in size from very small (less than 1 MWt) to a few rather high-powered reactors (up to 30 MWt). Most research reactors use low uranium density (about 20 weight percent) uranium-aluminum alloys containing highly enriched (93 percent) uranium-235, a potential weapons material.

Objective

The principal program objective is to improve the proliferation resistance of nuclear fuels used in research and test reactors—in particular, to provide means for reducing the enrichment of uranium fuel used in both foreign and domestic reactors, to substantially less than the current 90–93 percent enrichment, which will reduce the risk that enriched uranium might be diverted for non-peaceful purposes. More specifically, the program objectives are:

In the near-term, apply current fuel fabrication technology to use reduced-enrichment fuels—enrichment can be reduced from

90–93 percent to 20–45 percent in many plate-type fuel designs without reducing the design margins, and to below 20 percent in some additional reactors.

In the long-term, to develop and apply high uranium density fuel technology that will permit the use of fuels enriched to less than 20 percent in all research and test reactors (except possibly only the highest power systems) and to provide the technical support necessary to make the high uranium density fuels commercially available.

Strategy and Scope

The basic strategy of the Reduced-Enrichment Research and Test Reactor (RERTR) program is to develop, fabricate, test, and install fuel of reduced enrichment in research and test reactors now requiring highly enriched uranium (HEU) fuels. The primary technological means to be utilized to achieve the objective consists of increasing the uranium density in the fuel beyond those currently use in research and test reactor fuels, up to presently demonstrated maximum uranium loadings.

COMMITTEE ACTION

Advanced reactor systems—$2.0 million decrease

Because of budget constraints, funding for the Reduced Enrichment Research and Test Reactor project was reduced by $2 million. This decrease reflects the Committee's observation that research and test reactors (usually 1 megawatt or smaller) are not generally considered to be major proliferation threats.

The basic strategy of the Reduced-Enrichment Research and Test Reactor (RERTR) program, to develop, fabricate, test, and install fuel of reduced enrichment in research and test reactors now requiring highly enriched uranium (HEU) fuels, has not been changed. The primary technological means to be utilized to achieve the objective consists of increasing the uranium density in the fuel beyond those currently used in research and test reactor fuels, up to presently demonstrated maximum uranium loadings. The Reduced funding will result in some delay in the projected schedule for achieving reduced fuel enrichments.

2. CIVILIAN WASTE MANAGEMENT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
OPERATING EXPENSES					
erminal isolation R. & D.	144, 150	192, 939		−33, 000	159, 939
Vaste systems evaluation and public interaction (supporting studies)	1, 600	7, 500		−6, 000	1, 500
Vaste treatment technology	19, 200	27, 450 [2]		−3, 500	23, 950
Subtotal, operating	164, 950	227, 889		−42, 500	185, 389
rogram direction	1, 365	1, 762			1, 762
Subtotal	166, 315	229, 651		−42, 500	187, 151
CAPITAL EQUIPMENT					
erminal isolation R. & D.	9, 800	9, 760		−1, 700	8, 060
Vaste treatment technology	2, 500	3, 550			3, 550
Subtotal, capital equipment	12, 300	13, 310		−1, 700	11, 610
CONSTRUCTION					
onstruction, authorization		12, 376		+2, 200	14, 576
onstruction, budget authority	11, 800	12, 376		+2, 200	14, 576
Total, civilian waste management	190, 415	255, 337		−42, 000	213, 337

[1] Includes changes to original fiscal year 1981 budget authority request.

[2] Includes $5 million for the West Valley, N.Y., Demonstration that was originally placed in Title V.

verview

The Administration's activities in nuclear waste management are uided by the conclusions of the Interagency Review Group (IRG), hich published its final report in March, 1979, and by the followup Presidential position paper on February 12, 1980. This Presidential osition paper called for establishing a comprehensive National Plan or Radioactive Waste Management. The draft of this plan is expected y September 1980, and the final plan is targeted for issuance on anuary 1981. The plan will present:

An overview of the total program effort and goals;
Basic strategy and logic sequence of key events;
Participants and responsibilities; and
A schedule for activities.

The Administration places primary emphasis upon disposal of pent-fuel elements from civilian nuclear reactors in mined reposiories at full geologic depths, rather than upon reprocessing of the uel in order to extract the wastes for disposal. In the February 12, 980 statement of the President, the goal was to identify a site in 1985 or a repository, which would be completed in the mid-1990's. However, wo months later, the April 15, 1980 "Statement of Position of the

U.S. Department of Energy" on the Nuclear Regulatory Commission (NRC) Waste Confidence Rulemaking (DOE/NE-0007) delayed the repository completion to between 1997 and 2006. In the Administration's program, this licensed repository would be for both civilian spent fuels and defense wastes.

Having completed production of two full-size, high-level waste vitrified (glassified) monoliths (solid "logs", 1 foot in diameter and 10 feet long) in FY79, the Administration is concentrating efforts in solidification of wastes upon research into alternative methods and upon boards and panels for certification and advice.

For low-level wastes, the Administration is continuing development of volume reduction and incineration. The DOE has stopped using commercial burial grounds for its low-level wastes after the late-1979 closing of two of the three civilian low-level waste burial grounds. The 14 active low-level nuclear waste burial sites being operated by the DOE are currently available only for its usage.

In the latter part of 1979, a particularly severe shortage of commercial low-level waste burial facilities existed while two of the three commercial sites were temporarily closed. Considerable national attention was consequently given to the need for additional non-federal burial grounds. The State Planning Council, which was appointed by the President in response to an IRG recommendation, is particularly concerned about possibilities for additional civilian low-level waste burial grounds.

Overall, budgets for civilian waste management have increased rapidly over the past several years to a level that in FY80 has become a major national expenditure.

COMMITTEE ACTION

Civilian Waste Management—$42 million decrease

The Committee made substantial redirections and funding reductions in the Administration's program, which focused upon long-term preparations for repositories and other activities. The Committee directed instead that the focus be upon near-term demonstration programs. Under the Terminal Isolation R&D subsection and the Waste Treatment Technology subsection, the Committee directed that technology-demonstration facilities be constructed.

Licensing

Paragraph 107(B)(4) of the bill requires that the demonstration waste solidification facilities and the demonstration repositories are to be constructed and operated as non-licensed facilities. The Committee intends that this paragraph reaffirm the existing general rule of law (subject to four exceptions noted below) that the Nuclear Regulatory Commission shall not have licensing and related regulatory authority pursuant to the Atomic Energy Act of 1954, as amended, over Department of Energy facilities, whether commercial or research, development and demonstration facilities. The Committee, however, encourages the Department to consult with the Nuclear Regulatory Commission at all levels of design, construction and operation to assure that any comments that the Commission has are appropriately considered in the waste management program.

The Committee believed it was necessary to restate the law in this area because of the misconceptions shared by many concerning the need for licensing federally-run facilities. The Committee observes that, unlike activities in the commercial sector, the Department's research, development and demonstration activities are managed as a Federal activity and are conducted in part for the purpose of defining the technology as well as the parameters from which the licensing policies are formulated. It would be inconsistent to attempt to license a technology prior to the time when technical positions, or policies, have been formulated.

The Committee recognized that Section 202 of the Energy Reorganization Act (ERA) created four exceptions to the no-licensing rule of the Atomic Energy Act, none of which apply to the facilities authorized in Section 107(B) of the bill. In particular, paragraph (3) of Section 202 of the ERA exempts from the no-licensing rule those DOE "Facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from activities licensed under such (Atomic Energy) Act." The Committee has specified in paragraph 107(B)(3) of the bill that all of the authorized facilities are to be used for the purpose of research, development and demonstration to develop the necessary data and information for full-scale repositories and to confirm the existence of technological solutions for safely disposing of high-level radioactive wastes. Thus, the demonstration repositories are not to be used primarily for the purpose of receiving and storing high-level wastes, although receipt and storage is required to effectuate the R,D&D purpose. For this reason, the demonstration repositories are not within the purview of this exception. In addition, subparagraph 107(B)(3)(b) of the bill requires that the Secretary use wastes primarily resulting from unlicensed activities. This requirement creates a second independent condition not within the terms of this exception.

Consultation and Coordination—Paragraph 107(B)(3)(d)

The Committee requires that the Department consult and coordinate with appropriate state, local, and Indian-Tribe officials about any actions planned or conducted within their regions. The Committee is deliberately using the term "coordinate", rather than the term "concurrence" used by the Interagency Review Group (IRG) and by President Carter in his February 12, 1980, statement. The Committee believes that "concurrence" connotes a veto, either explicitly or implicity, contrary to the preemptive nature of the Atomic Energy Act of 1954, as amended.

The Committee believes that coordination should include full exchange of views between the Department and other such officials, including a thorough response from the Secretary to the chief governing officer of the state, locality, or Indian Tribe, on all outstanding concerns before any significant action on demonstration repositories or site characterization is taken. The consultation required by the Committee must include early notification by the Department to such officials about proposed site explorations, including details of any plans.

The Committee expects that the wastes at West Valley, New York, will be acquired by the Secretary in accordance with paragraph 107

(B)(7) of the bill, prior to emplacement in the repository. These wastes result primarily from the unlicensed N reactor at Hanford, Washington, and may therefore be utilized, consistent with the authorization in subparagraph 107(B)(3) (b) and (c) of the bill. The Department's wastes from defense activities as well as from its research and test reactors may similarly be utilized.

(a) TERMINAL ISOLATION R&D

In the Administration program, spent fuel will be encased in metal canisters and placed in deep geological repositories, with provisions for retrieval. Particular attention is given to the geology of the sites in order to assure that the long-lived radionuclides, particularly uranium and plutonium, do not migrate to the biosphere. Consequently, the focus of the program is upon detailed geologic and hydrological investigations. Research on overpack cansisters for reprocessed wastes, which is an important component of engineered barriers, is being conducted in a limited program.

Objective

The objective of the Administration's program is to identify and to use test hole drillings to explore several sites in various geologic media in the United States. These are to include salt, basalt, tuff, granite, and possible other media. After site selection by 1985, a repository will be built with operation scheduled for 2006, or perhaps as early as 1997. The program involves thorough consultation and concurrence procedure with the states, localities, and the Indian tribes with the objective of keeping the public and its officials involved and informed in the process.

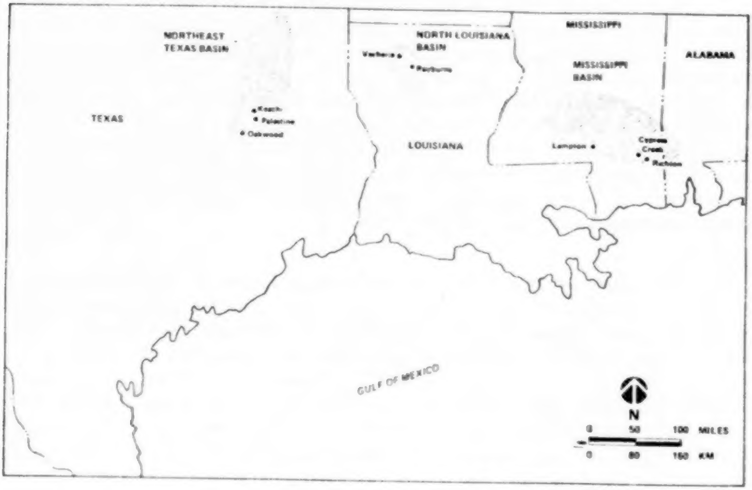
Strategy and scope

The Administration's program has heretofore concentrated on the use of salt as the geologic-medium for disposal. The Los Medanos site in Southeast New Mexico has been under consideration for the Waste Isolation Pilot Plan (WIPP) and is the best explored and characterized of salt locations. The Administration intends to rescind the WIPP project, which is now under the defense program, and to have this site available for a repository under the civilian program. $21 Million of FY 81 funds are requested by the Administration to continue securing land and rights for this site and continue the development program.

Potential alternative salt locations include eight salt domes in the Gul states—three in Texas, two in Louisiana, and three in Mississippi. However, little field exploration has been conducted for these salt domes. Other possibilities are in the bedded salt of the Paradox Basin on Federal land in Southeast Utah. One full-depth core drilling will be completed by the end of FY 1980 in Gibson Dome.

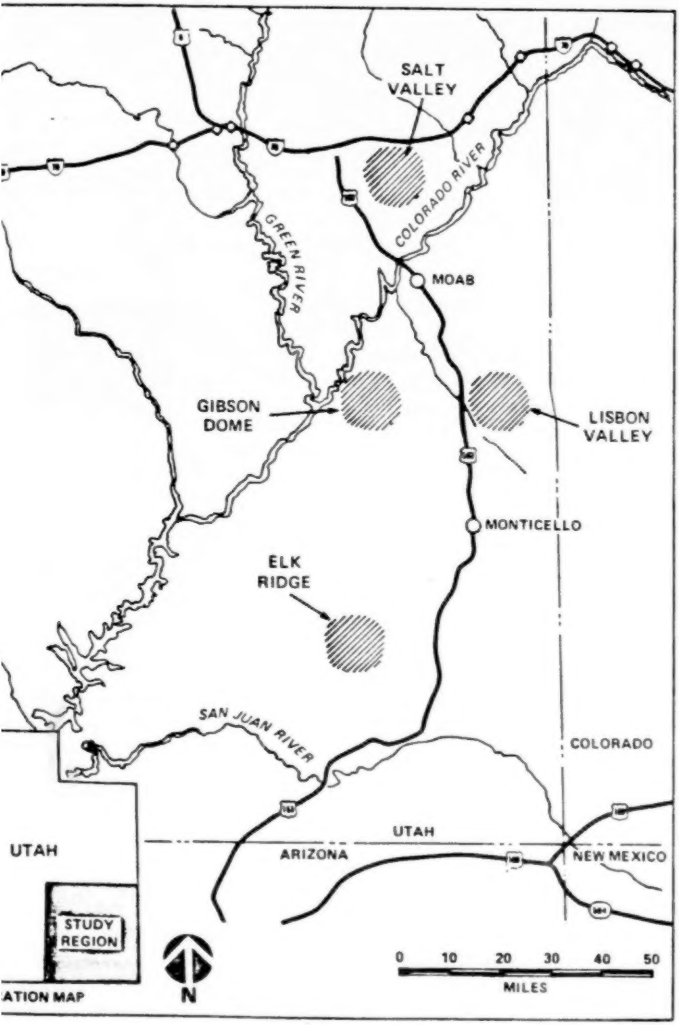
With regard to other geologic media, three acceptable repository locations have been identified for possible disposal in basalt in the Hanford, Washington, area on the basis of extensive core drillings over recent years. Pursuant to NRC recommendations for considering granite media, field investigations in granite are being considered. To explore the possibility of disposal in tuff, a partial-depth core drilling has been made at Yucca Mountain near the southwest part of the Nevada Test Site (NTS). A full-depth exploratory hole will be completed in FY 80.

Concurrent with these site explorations, demonstrations of emplacing spent fuel and wastes at the surface and at geologic depths have been undertaken at several locations in granite, salt, basalt, and soil.


NORTHEAST TEXAS BASIN
TEXAS
Keechi
Palestine
Oakwood
NORTH LOUISIANA BASIN
Vacherie
Rayburns
LOUISIANA
MISSISSIPPI
MISSISSIPPI BASIN
ALABAMA
Lampton
Cypress Creek
Richton
GULF OF MEXICO
N
0
50
100 MILES
0
80
160 KM

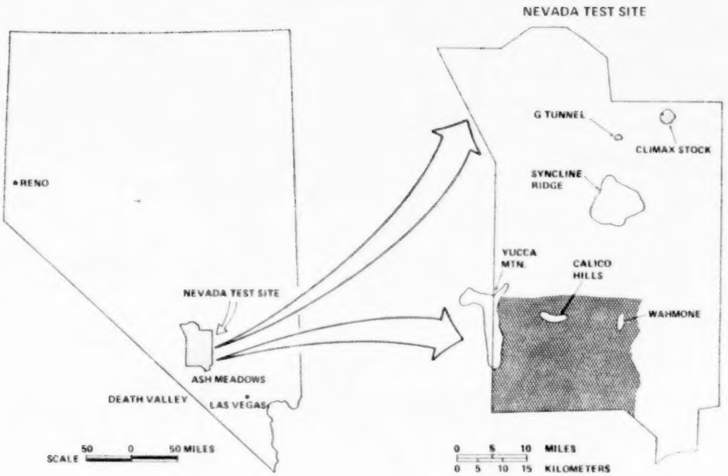
Gulf Interior Region Gulf Coast Salt Domes Recommended for Further Study by the U.S. Geological Survey

Source: R. E. Anderson, D. H. Eargle, and R. O. Davis, *Geologic and Hydrologic Summary of Salt Domes in Gulf Coast Region of Texas, Louisiana, Mississippi, and Alabama*, Open-file Report USGS–4339X2, U.S. Geological Survey, 1973; and J. O. Ledbetter, W. R. Kaiser, and E. A. Ripperger, *Radioactive Waste Management by Burial in Salt Domes*, p. 82. AEC Contract AT 40–1–4639, Engr. Mechanics Research Lab., University of Texas, Austin, Tex.


SALT VALLEY
COLORADO RIVER
GREEN RIVER
MOAB
GIBSON DOME
LISBON VALLEY
MONTICELLO
ELK RIDGE
SAN JUAN RIVER
COLORADO
UTAH
ARIZONA
NEW MEXICO
UTAH
STUDY REGION
ATION MAP
N
0 10 20 30 40 50
MILES

Areas of the Paradox Basin Identified for Further Evaluation

R. J. Hite and S. W. Lohman, *Geologic Appraisal of Paradox Basin Salt De-*
Waste Emplacement, Open File Report 4339-6, U.S. Geological Survey, 1973



Location of the Nevada Test Site In Nevada

Current Exploration on Areas (Shaded) and Supporting Test Facility Areas (Stippled) at the Nevada Test Site

COMMITTEE ACTION

Terminal isolation R. & D.—$33.5 million decrease

The Committee made an overall $33.5 million decrease in the Administration's proposed budget for Terminal Isolation R&D programs.

Wastes from Reprocessing

The Committee recognizes that the focus of the Administration's program on the disposal of spent fuel as waste is dictated by, and supportive of, the Administration's stated policy of indefinitely deferring the reprocessing of spent fuel. This policy is explicitly coupled with the deferral of breeder reactors into the next century. The Committee, based on its investigations and the results of the National Academy of Sciences, Committee on Nuclear and Alternative Energy Systems (CONAES) report and the International Nuclear Fuel Cycle Evaluation (INFCE) study, supports a strong breeder program and the need to develop proliferation-resistant fuel cycle methods.

The energy content of the spent fuel discharged annually from the existing licensed nuclear power plants is the equivalent of about 250 million barrels of oil. If breeder reactors are used, the energy equivalent could be raised to about 12 billion barrels of oil annually. If all of the existing 7,500 tonnes of spent fuel is reprocessed and the unburned uranium and plutonium utilized in a breeder reactor, the nation would have the energy equivalent of 1/6 of all the proven oil reserves of the Middle East. In view of this enormous energy potential, the Committee is unwilling to adopt a policy that our nation ought to discard spent fuel, especially when most of the concerned foreign governments have decided to develop both reprocessing and breeder reactors.

Safe disposal of spent fuel is also more difficult than is waste from

cessed fuel. The long-lived uranium and plutonium in spent fuel
reater hazard than reprocessed wastes, even after several hundred
, and basically different methods are required to keep it safely
from the biosphere. These methods for spent-fuel rely on
y ideal geology for isolation, even though considerable uncer-
es exist in predictions for future geologic performance. There-
Section 123 requires that no funds will be spent for disposal of
fuels or to prepare for such disposal unless the spent fuel ele-
s can be retrieved at a cost that is small compared to both the
f the facility and the emplacement, and can be done with negli-
radiological risk.

eered Barriers—Paragraph 107(B)(3)(c)

e Committee redirected the Administration's civilian waste dis-
program to shift the emphasis to disposal of reprocessed wastes.
wastes have, at most, 0.5% of the plutonium and uranium con-
ontained in spent fuel, and decay sooner to safe levels of activity.
onsequence, reliance can initially be placed upon engineered bar-
which include the waste form and the surrounding overpack
ers, to contain the wastes. This redirection significantly reduces
ed for ideal geology, since the geology is primarily a secondary
r. The geologic media will minimize the likelihood of disrupting
aste form and canister barriers and limit the dispersal of radio-
ty in the unlikely event any is released from the engineered bar-
The geology is important as a sequential barrier for the time
the danger of the wastes has markedly decreased.

implement the program that was directed by the Committee, the
rtment must first evaluate the necessary criteria for design of
gineered barriers. One of these criteria is the time during which
rly functioning engineered barriers will fully contain the wastes.
econd criterion is the possibility of failures, and the resulting
leakage, from individual canisters during this time.

evaluate this first criterion, the Department is authorized and
ed to determine the time when the health hazard from the wastes
parable to the health hazard from the quantity of uranium ore
which the wastes result. Wastes result from use of uranium for
n reactors for electricity generation. In this comparison, wastes
nsidered to be from the first recycle to mixed-oxide fuels. Health
ds are the carcinogenic effect of the radioactive content of the
s and of uranium ore, as determined by federal regulations apply-
whole-body effects upon ingestion by a typical age distribution
human population. The DOE can utilize the many existing
risons between these health hazards or its own comparisons in
nining the time for engineering-barrier reliance.

evaluate the second criterion, Department should consider the
ical possibilities of failures in the number of solidified waste
iths and the surrounding overpack canisters, due to manufactur-
ults, handling difficulties, and initial effects with the repository.
eered barriers should be designed so that the health hazard of
s released for the most likely failure modes is comparable to, or
an, the health hazards of the uranium ore.

rough the use of these criteria in constructing a repository, the
the public is expected to be less than the risk from the original

ore body while it is in the ground. This results from two factors. The first factor is the smaller possibility that any such released wastes will reach humans than the possibility that uranium ore in the ground will reach humans; repositories will be much deeper than mined bodies of uranium ores, and repository sites will be chosen to minimize migration of wastes through the geologic medium. The other factor is that the health hazard from hypothetical ingestion of all the released wastes is comparable to, or less than, from hypothetical ingestion of all the corresponding uranium ore.

The Department should consolidate its materials-science activities into the Waste Treatment Technology program. Overpack canister development is therefore discussed under that program in this Report. The Committee reduced the Administration's planed 5 year effort to identify a geologic site for a full size repository to a requirement of identification by the end of the first quarter of FY 1981 of a site for a technology-demonstration repository. This is based on geologic media serving as a second line of defense. The logic is a sequence of primary barriers, rather than the unduly restrictive initial primary reliance upon geology.

Technology-Demonstration Repositories—Paragraph 107(B)(3)(b)

The Committee directed the construction of four (4) technology-demonstration repositories based upon existing technology, the adequacy of which has been confirmed by consensus of experts. The purpose of the projects is to demonstrate technological solutions for safely disposing of high-level wastes. The Committee directed that $78.4 Million be utilized for site exploration and investigations to locate and prepare sites for the 4 technology-demonstration repositories by specified dates and to similarly prepare for full-size subsequent repositories.

The first of these demonstration repositories was authorized as Project 81–H–01 at $6 Million for Title I Preliminary Engineering (including geological survey work), initiation of Title II Design, and commencement of site construction. This project is to be in operation in 1986. See Section M, Construction of Facilities, for details on construction.)

The second repository was authorized as Project 81–H–02 for $2 Million. This repository is to be in operation in FY 87. Each of the 4 technology demonstration repositories is to contain a minimum of 40 monoliths of vitrified wastes encased in overpack canisters. The total number of canisters should be sufficient for necessary research and development on handling, engineering, space, configurations, and heat dissipation. The Department should announce the locations of the first two repositories concurrently.

In directing this total of $8 million in the budget for these two technology-demonstration repositories, the Committee did not designate in which subprogram these repositories would be located. (Therefore, this $8 million increase is not contained in the Committee's changes described at other places in this report.)

Repository Locations—Paragraph 107(B)(3)(a)

The Committee instructed that sites should be geographically distributed through major regions of the country and be in various geologic media. This will provide widely spread demonstrations in all of the candidate geologic media. Sites should preferably be on federal land, including land where wastes have been stored or deposited. The repositories are to be located and constructed to be suitable for later extension to full-size repositories. Wastes and canisters are to be of design suitable for full-scale repositories. The program is intended to provide valid demonstration of waste disposal technology as well as to provide the possibility of expending demonstration facilities to full scale repositories, if determined to be appropriate at some future date.

The major regions of the nation are loosely defined in order to provide the Department with latitude to distribute the four sites across the nation. The Department may consider somewhere in the zone between 85° and 90° latitude for an eastern-central boundary and somewhere in the zone of 105° and 110° latitude for a central-western boundary.

The Committee determined that excavation for shafts for these technology-demonstration repositories will not be a major Federal action in order to be consistent with the NRC proposed rule in its "Disposal of High Level Radioactive Wastes in Geologic Repositories; Proposed Licensing Procedures", and with other site-characterization practices. Full-size shafts are expected to be required for equipment access for underground site characterization. The Committee authorizes and directs the Department to start preparations of a draft environmental impact statement (DEIS) at the time when each site is identified and to prepare the DEIS while evacuation for shafts and site characterization are underway. The schedule for environmental impact statements should minimize any time delay between site characterization and the start of other construction of the repositories.

The Committee decreased the Capital Equipment budget for Terminal Waste Isolation by $1.7 Million (which is not described at any other place in this report). Part of the equipment costs are saved by confining experiments to pressure, temperature, and moisture conditions that will realistically be encountered in properly designed repositories.

Considerable importance should be placed upon the extensive geologic investigation in salt at the Las Medanos site in southeastern New Mexico and in basalt at the Hanford site. The large number of full-depth test drillings at both locations was to prove geology for disposal of spent fuel and other long-lived radioactive materials, but also provides important information on the adequacy of the first one or two full-depth drillings to provide geologic information for waste disposal with engineered barriers. It would be desirable for the Department to use this information to identify sites with as few as one full-depth drilling, although additional drillings can continue while shafts are being excavated for site characterization.

The DOE currently has a broad program developing theoretical models of radioisotopes migration in various media, largely by computer analyses. The large expenditures planned for FY 1981 and beyond need to be restructured, and correspondingly reduced, because sufficient information has been developed to date and because of the redirection by the Committee from primary reliance on geological isolation to primary reliance on engineered barriers. The demonstration repository program formulated by the Committee shall take funding precedence over Other Programs, pursuant to subparagraph 107(B)(1)(e) of the bill. Specifically the DOE could reduce expenditures on ground water transport modeling to provide funds necessary for the demonstration program. Adequate progress in transport modeling can be achieved at reduced funding by coordinating modeling studies within the DOE and other government agencies to eliminate duplication of effort. Any urgency in completing this far-field modeling has been further reduced by the extensive delay in the major milestones of the Administration program for a full-scale repository, now scheduled for operation as late as 2006.

The emphasis in modeling efforts should be changed to the near-field conditions appropriate to initial reliance on engineered barriers, rather than the current focus on far-field conditions, which is more appropriate for primary reliance on geologic media for spent-fuel disposal.

OFFICE OF NUCLEAR WASTE ISOLATION (ONWI)

The Administration has proposed a significant increase in funding for the ONWI project, of which $21 Million is in preparation for a civilian waste repository at the WIPP site. Implementation of this proposal depends upon any Congressional approval of the President's request for rescinding FY 1980 funds for WIPP. The remainder of the increase in funds is largely for continued site investigations in various geologic media.

Objective

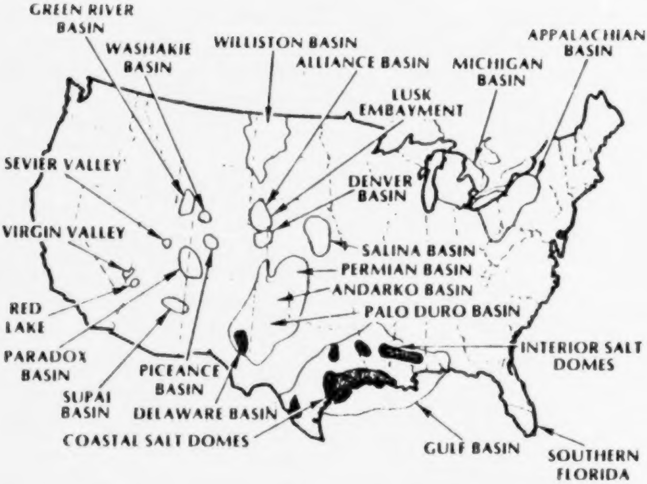
The main objective is to investigate methods and locations for a full-size repository, particularly for sites other than Hanford and the National Rocket Test Station (NRTS) at the Neveda Test Site (NTS), which are separate subactivities. The objective of the Administration program for WIPP is to secure rights at the site and plan a repository for a civilian program. A test facility in a salt mine is planned as an extension of the Project Salt Vault tests in Kansas and tests in Germany.

Strategy and scope

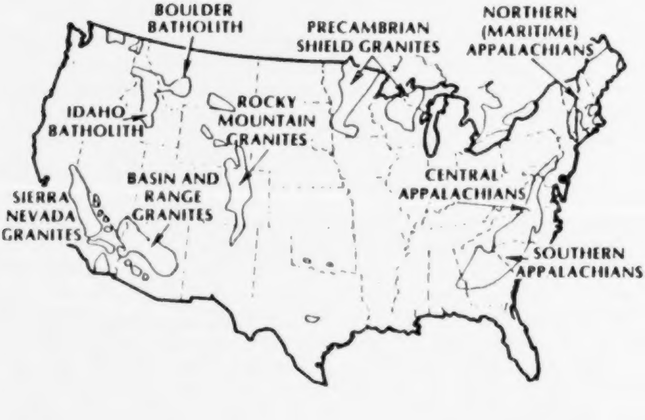
The Administration has requested that the Congress rescind WIPP as it has been planned for the National Defense program in order to make this Las Medanos site available for a combined civilian spent-fuel and defense-waste repository. Continued underground explorations, including those in salt and granite will be conducted at other locations on Federal lands and where arrangements have been made on non-Federal lands. Negotiations are being conducted with states and localities to obtain cooperation and permission for drillings.

The ONWI task is being conducted by the Battelle Memorial Institute at Columbus, Ohio, under DOE's Richland Operations Office. Systematic evaluations of the safety and reliability of deep geologic disposal of spent fuel elements is being conducted. This activity is coordinated with mathematical models and with the development of appropriate techniques and instrumentation.

Preparations are being made for licensing full-size repositories and satisfying the requirements of the National Environmental Policy Act (NEPA). Also, socio-economic studies of public perceptions and outlooks and of the economics of waste disposal are being conducted.


GREEN RIVER BASIN
WASHAKIE BASIN
WILLISTON BASIN
ALLIANCE BASIN
MICHIGAN BASIN
APPALACHIAN BASIN
LUSK EMBAYMENT
SEVIER VALLEY
DENVER BASIN
VIRGIN VALLEY
SALINA BASIN
PERMIAN BASIN
ANDARKO BASIN
PALO DURO BASIN
RED LAKE
PARADOX BASIN
INTERIOR SALT DOMES
PICEANCE BASIN
SUPAI BASIN
DELAWARE BASIN
COASTAL SALT DOMES
GULF BASIN
SOUTHERN FLORIDA

ROCK SALT DEPOSITS


BOULDER BATHOLITH
PRECAMBRIAN SHIELD GRANITES
NORTHERN (MARITIME) APPALACHIANS
IDAHO BATHOLITH
ROCKY MOUNTAIN GRANITES
BASIN AND RANGE GRANITES
CENTRAL APPALACHIANS
SIERRA NEVADA GRANITES
SOUTHERN APPALACHIANS

GRANITIC FORMATIONS

Geologic formations in the United States.

COMMITTEE ACTION

Office of Nuclear Waste Isolation—$31.3 million reduction

The Committee believes that the ONWI program should be redirected to emphasize the development of technology demonstration repositories, with the goal of maintaining the possibility for future expansion into full-size repositories.

The Committee deleted the proposed $6.8 Million for a salt test facility, since this activity would basically repeat earlier tests, and cannot be developed into a repository. No clear plan for extensions of the research in mines has yet appeared that indicates urgency for this program. Any needs for supplementary tests in salt that later develop should probably be done more economically in laboratories or in existing underground facilities, such as existing tests in German mines.

The Committee reduced the Administration request for ONWI by $31.3 Million. The Committee wishes the WIPP project to continue as a defense activity. See Section 107(B)(2) of the bill. Therefore, $21 Million of the Committee's reduction in ONWI funds represents the elimination of WIPP as a civilian activity.

Funds for ONWI should be flexible to accommodate important needs. Specifically, these funds should continue to be available to provide reprogrammed funds for Public Interaction and for any supplementary needs for the State Planning Council. In addition, these funds should be available for reprogramming to cover increased needs for overpack canister development and any increased needs for low-level waste treatment technology.

Technology-demonstration repositories are needed earlier than the licensing of full-size repositories. Therefore, funds in the activity "site and repository licensing" were reduced by $2.6 Million. The remaining $2 Million was transferred to Title VII, since the scope of this activity is broader than R&D alone.

BASALT WASTE ISOLATION PROGRAM

This program is centered on high-level waste disposal preparations conducted at the Hanford Site in Washington.

Objective

Part of this program is to identify a suitable site for deep geologic disposal in the thick basalt flows underlying the Columbia River Plateau, with emphasis on the Hanford site. The Near-Surface Test Facility (NSTF) is being used for background experience with basalt, including heater tests in FY81 and later emplacement of spent fuel and solidified wastes in this facility for experience with thermal and radiation effects.

Strategy and scope

Basalt investigations are concentrated on DOE's Hanford Reservation, located in Southeastern Washington. The geologic system is layered formations of basalt (a dense fine-grain rock formed by the solidification of lava).

The lead management role of this program is under DOE's Richland Operations Office. Rockwell Hanford Operations (Rockwell International Corporation) at Hanford, Washington, provides technical assistance for management activities.

Three candidate sites suitable for either a technology demonstration repository or a full-size repository have been identified. Final site identification can be made by early FY81. Investigations have been based on a comprehensive drilling and testing program, including many deep test holes to provide subsurface geologic, geophysical and hydrological data. Additional information has been obtained from survey mapping, ground water investigations, analytical modeling, and seismic monitoring.

The NSTF on Gable Mountain will provide in-situ tests of electrical heaters, commercial spent fuel tests, and a spent fuel canister in basalt. These tests, begun in 1979, are to assist in repository design by confirming the thermal properities in basalt, determining the effects of fractures and discontinuities in heated regimes and obtaining in-situ data to validate theoretical effects. Preparations are being made for radioactive loadings. Spent fuel will be characterized, packaged, and shipped from the Engine Maintenance and Disassembly (EMAD) facility at the Nevada Test Site (NTS). The tests will run for approximately three years, followed by the removal of test hardware, including spent fuel. A contract has been awarded to an architect engineering firm for performing a conceptual design of a full-size basalt repository for spent fuel at full geologic depths, including remote handling. The conceptual design is to be completed in September 1981.

COMMITTEE ACTION

Basalt waste isolation program—$5 million decrease

The Committee reduced the proposed budget for the Basalt Waste Isolation Program by $5 million. This decrease represents a change in emphasis from exploratory measurements of geology toward the Committee's program of technology demonstration repositories with emphasis on engineered barriers.

All demonstration tests, including use of the NSTF with radioactive materials, are of importance in providing the available technology for waste disposal. The emplacement of spent fuel and radioactive wastes are not to be delayed by this budget decrease. Since the technology-demonstration repositories emphasize near-field conditions, budgetary savings could be obtained from the reduced needs for calculations of migration through far-field conditions. Additionally, since the technology demonstration repositories are unlicensed, budgetary savings are available in licensing preparations.

NEVADA TERMINAL WASTE ISOLATION

The Nuclear Rocket Test Station (NRTS) and other Federal land at the Nevada Test Site provide locations, suitable for tests with high-level wastes and spent-fuel wastes and for a possible repository site.

Objective

Objectives are development and actual experience in handling of civilian high-level radioactive waste materials in the Engine Maintenance and Disassembly (EMAD) Building of the NRTS for emplacement in the NSTF at Hanford, in the Climax Stock facility at the NTS, and in the surface storage facilities of caissons and a silo outside the EMAD Building. Another objective is core drilling investigations at Yucca Mountain and heater tests to determine suitability of tuff for a civilian repository.

Strategy and scope

The DOE's NTS, located in Southern Nevada, is being investigated for potential repository sites and is being used for demonstrations of waste storage. Unlike other candidate sites, this site provides varied geologic systems including granite, argillite (a compact clay rock cemented by silica), and tuff (a heat-fuse volcanic ash). Investigations of the suitability of locating a repository on, or adjacent to, the NTS have determined that no major impediments to other functions of the NTS exist, provided the location is at, or adjacent to, the Nuclear Rocket Test Station, which is located in the southwestern part of the site. This location contains the EMAD building and other facilities for handling highly radioactive materials.

In investigations of the suitability of various geologic media, only tuff was determined to be suitable both geologically and in terms of impediments to the operation of the NTS.

Yucca Mountain, which is located immediately adjacent to the NRTS on the Nellis Air Force Range, is under active investigation for geologic suitability. Intermediate-depth core holes have been drilled for geologic and hydrologic investigations in FY 1980. A full-depth geologic test drilling now underway will be completed in FY 80.

Radionuclide transport studies are under way by the Los Alamos Scientific Laboratory to evaluate the effectiveness of granite, tuffs, and shale as a waste migration barrier. Investigations have determined that both surface and subsurface seismic activity resulting from weapons testing at NTS are consistent with safe operation of repositories designed to meet ground-motion design criteria. In-situ testing in tuff in the G Tunnel in the northern part of the NTS is under way to determine the response to thermal loading.

The EMAD Building has been used for handling of spent fuel elements, their emplacement in stainless steel overpack canisters, and remote handling to seal the canisters. A total of 19 highly-radioactive spent-fuel elements have been received through FY 1980 and successfully placed and welded in canisters.

These canistered spent-fuel elements are to be used in various tests to determine suitability for surface storage at NRTS, near-surface tests (at the Hanford site) and for full-depth tests in the Climax Stock granite in the 1400-foot deep "Pile Driver" underground tunnels in the northern part of the NTS. Eight of a total of 11 canistered spent-fuel elements have now been emplaced in this granite, in addition to heaters, for full tests of thermal effects.

The DOE Nevada Operations Office has the lead management role. Sandia Laboratories, Albuquerque, provides technical assistance, including plans, technology programs, and status and costs.

COMMITTEE ACTION

Nevada terminal waste isolation—no change

The Committee approved the Administration's budget for the Nevada Terminal Waste Isolation Program without change.

The demonstration projects being conducted at the NTS are very important. The schedule should be kept for overpack canisters, surface storage, and emplacements in granite. The spent fuel emplacement at 1400 feet in granite is allowable because it is definitely a temporary emplacement and because it is designed for easy and economic retrieval.

Great importance is similarly placed upon the investigations of site suitability in tuff at Yucca Mountain, so schedules for this should similarly be maintained. Sites for technology-demonstration repositories which have initial reliance upon engineered barriers may be located upon the basis of fewer full-depth drillings than have been utilized to characterize sites to date. The experience with multiple drillings at Los Medanos in salt and at the Hanford site in basalt should be used by the Department to determine if completion of one full-depth drilling suffices for site identification. Supplementary information about the geology can be continued with test drillings while other site characteration work is under way.

SEABED DISPOSAL

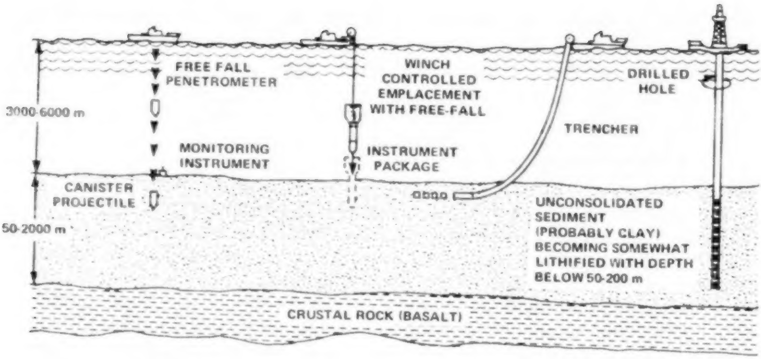
Seabed disposal is being investigated to provide possible future alternatives to underground disposal.

Objective

The primary objective of the Seabed Disposal Program is to assess the technical, environmental, engineering, and institutional feasibility of disposing of processed high-level nuclear waste and/or repackaged spent reactor fuel in geologic formations under the world's oceans. A secondary objective is to assess the seabed disposal options of other nations.

Strategy and scope

The Interagency Review Group (IRG) concluded that the option of seabed disposal is a nearer-term alternative approach to deep geologic disposal for waste isolation. The existence of deep-sea technology, such as deep seabed drilling, drill-hole reentry and deep-sea emplacement and recovery of large equipment, makes the deep ocean sediments a reasonable candidate for disposal of radioactive wastes. Thick, uniform, and stable deposits of ocean sediment have accumulated over millions of years and are in the process of becoming sedimentary rock. Disposal in such sediments could provide effective isolation of radioactive wastes from the biosphere. A major effort for FY 1981 is to assess potential sites in the North Pacific and North Atlantic.


FREE FALL PENETROMETER
WINCH CONTROLLED EMPLACEMENT WITH FREE-FALL
DRILLED HOLE
3000-6000 m
TRENCHER
MONITORING INSTRUMENT
INSTRUMENT PACKAGE
CANISTER PROJECTILE
50-2000 m
UNCONSOLIDATED SEDIMENT (PROBABLY CLAY) BECOMING SOMEWHAT LITHIFIED WITH DEPTH BELOW 50-200 m
CRUSTAL ROCK (BASALT)

Sediment Emplacement Concepts for Seabed Isolation

For purposes of the study, the reference seabed disposal system adopted the emplacement of appropriately treated waste or spent reactor fuel in a specially designed container into the clayey sediments in the middle of a suboceanic tectonic plate, under the hub of a surface circular water mass. Methods include free-fall penetration, surface controlled trencher for disposal into the seabed, and a ship borne drilling rig for deep drillings into the sediment. Current effort is in the determination of technical and environmental feasibility by the end of 1983 for concept feasibility from newly acquired oceanographic and effects data.

The U.S. is a participant in the international Nuclear Energy Agency Radioactive Waste Management Committee. The Committee includes a Seabed Working Group which discusses technical progress, future experiments, joint cruises, shared facilities and test equipment, technical information exchange, and international policy issues.

COMMITTEE ACTION

Seabed disposal—$3.5 million decrease

The Committee believes that the main focus should be upon technology demonstration repositories in geologic media. Moreover, the United States has made a unilateral declaration of not disposing of wastes, either high-level or low-level, in the world's oceans.

In view of both this priority and the U.S. policy, the seabed disposal program is a future consideration. The Committee correspondingly reduced the Administration's budget request by $3.5 million. The resulting budget of $4.5 million is an appreciable reduction from the $6 million FY 1980 budget, but is large compared to the $2.8 million FY 1979 budget and is commensurate with the present priority of the Program.

(b) WASTE SYSTEMS EVALUATION AND PUBLIC INTERACTION

is is a new program in the FY 1981 Authorization request for
d studies of waste manageemnt and for public interactions. It in-
es funding for the State Planning Council and for distribution
ates having prospective repositories for their use in evaluating
osals.

ctive

e Waste Systems Evaluation program provides studies that en-
pass all waste-management programs, particularly general sur-
of the status and direction of program funds. The Public Inter-
n funds are for State Planning Council operation and for states
ake their own independent determinations about prospective waste
gement plans in each affected state.

egy and scope

aste Systems Evaluation includes comprehensive planning for the
management program, interdepartmental program integration,
aration of generic environmental impact statements, and inter-
nal studies. The major expenditure for preparation of a generic
onmental impact statement to comprehensively cover all aspects
aste management was completed in April 1979 (DOE/EIS/0046–
with the completion of the final statement scheduled for mid-
Results of the Interagency Review Group (IRG) reviews were
shed in March 1979. Also, many overall assessments of waste
gement have been completed by the National Academy of
ces, with some continuing.

omprehensive National Plan for Radioactive Waste Management
ng prepared for the Administration, largely by the MITRE Cor-
ion with the assistance of the Human Affairs Research Center of
Battelle Memorial Institute. This Plan was started in December
and will continue through February 1981. It is to be the fulfill-
of President Carter's February 12, 1980 statement that a national
be developed upon the recommendations of the Interagency Re-
Group report.

ernational aspects of waste disposal have been thoroughly con-
d by Working Group 7 of the International Fuel Cycles Evalu-
(INFCE) study in its final report in Febraury 1980.

e funds for Waste Systems Evaluation requested by the Adminis-
n for FY 1981 are $1.5 Million.

e Public Interaction Program involves support for the State
ning Council (SPC) and provides direct support, through grants,
ates under consideration for waste repositories. The SPC was
d by President Carter through Executive Order 12192 on Feb-
12, 1980 and fulfills recommendations of the IRG. The SPC is
uled to operate for no more than 18 months after the date of
ation. It consists of governors, other regional officials, and a rep-

resentative of Indian tribes. Some heads of government agencies also participate. The SPC is planned to provide advice to the federal government on state relations and the planning and building of repositories, both for high-level and low-level wastes.

The State Planning Council is budgeted for $1.5 Million in the Administration FY 1981 request, although the Council itself estimates a budget of $1.7 is needed.

Grants to states under consideration for repositories are to be used for local studies and assessments of the impact upon the affected areas. The Administration requested $4.5 Million for state grants in FY 1981. This was based upon the possibility of 15 such states, each receiving an average of $0.3 Million.

COMMITTEE ACTION

Waste systems evaluation and public interaction—$6 million decrease

Major evaluations for the overall situation for waste management have already been completed. Greater needs now exist for actual construction of technology-demonstration repositories and solidification facilities. Accordingly, the Committee reduced the funding for waste systems evaluation by $1 Million and transferred the remaining $0.5 Million to the joint title VII, since the scope of this activity is broader than R&D alone.

Public interaction

The Committee reduced funding for the State Planning Council by $0.5 Million. The previous groundwork by the Department, through the many conferences and meetings that have been held for state and local involvement, covers some of the funding needs of the SPC. Any additional funds needed for the SPC should be reprogrammed from the Office of Nuclear Waste Isolation (ONWI).

The Committee deleted the $4.5 million requested by the Administration for direct support through grants to potential recipient states. Moreover, the Committee required that no funds in this category may be used by persons or groups with established positions on the activity under consideration, either as a direct grant by the Department or a secondary grant through states or other governmental entities. Governmental agencies, such as the Department and the U.S. Geological Survey, necessarily advocate positions which are allowable for this funding, since these are in the execution of necessary functions of the government. In contrast, groups or persons with established positions, which are often based on political or nontechnological factors, are not to receive funds for any activities under Titles I and VII, either directly or on a secondary pass-through basis.

Any funds needed for this program should be reprogrammed from the Office of Nuclear Waste Isolation (ONWI) program to the category of Public Interactions, after appropriate notice to the Committee. Funding for this activity has heretofore been from such waste management sources. In planning for the future repositories, ONWI is in the best position to evaluate the competition for public-interaction funds between state programs and federal programs and the competition for funds between public information and technical programs. The appropriate distribution of these funds will change as the program in technology demonstration of repositories and waste solidification proceed.

(c) WASTE TREATMENT TECHNOLOGY

view

ıe objective of this program is the development of technology for ›bilizing wastes from nuclear fuel cycles and other sources and ›rting these to forms which provide:

Safety and economy of management,

Fulfillment of regulatory requirements, and

A form acceptable for burial or disposal.

ıe processes involve a variety of wastes including high-level and evel liquids, low-level solids, transuranic (TRU) contaminated s, and gases. Processes are required for reducing the volume, conng the materials to stable and less dispersible forms for safe transıtion, and isolating the materials from the biosphere by either ıl for low-level wastes or deep-geologic disposal for high-level or uranic wastes.

ıch of the technology is similar to that required for immobiliza›f defense wastes. Therefore, the R&D program for civilian wastes ing developed in close coordination with related defense wastes ıgement programs to assure timely transfer of knowledge and ›ience.

FY 1981, advanced research in different methods of treating and ›bilizing wastes will be conducted as well as pilot scale waste treatdemonstrations for gaseous liquid, and solid wastes. Support will be provided by the Transportation Technology and Information ›r for related transportation issues.

COMMITTEE ACTION

e treatment technology—$2.5 million decrease

e Committee reduced the overall operating and capital equipment et for all categories of waste treatment technology by $3.5 Million rt of a general reduction in funds and increase the budget for ruction by $1 million.

vertheless, the Committee strongly supports demonstrations of treatment technology, particularly for high-level wastes, such West Valley, New York.

ıterial sciences activities should logically be under the same manent, particularly for both high-level waste solidification and ıack canisters for wastes. The Committee established an overall et of not less than $9 Million for the combination of these two ories. The Department has given far too inadequate attention to opment of advanced metal overpack canisters for wastes, and as sequence developments have lagged far behind the development ıinless steel containers for spent fuel elements for intermediate-time storage. The limited development work already done by the Department both in laboratory-development metallurgy and in canister construction should, to the extent that is feasible, logically be expanded at the same facilities and continue under the same administrative structure as has been used, in order to make best use of present developments and to expedite progress.

Experience should be obtained in actual construction in fiscal year 1981 of full scale, or nearly full scale, canisters of highly resistant material suitable for waste disposal. Demonstrations of welding, or other siutable closure methods, suitable for remote operation should be included.

AIRBORNE WASTES

Objective

Methods are to be developed and demonstrated for capturing and encapsulating radioactive gases, particularly from nuclear facilities, in a manner which protects the public health and safety, produces minimal environmental impact, and meets all applicable laws and regulations.

Strategy and scope

Radioactive gases come from nuclear reactors, spent-fuel storage, spent-fuel reprocessing and waste-treatment processes such as waste incineration and vitrification. In addition, a nuclear accident, such as at Three Mile Island, can result in gases being released in containment or auxiliary buildings.

Included in the project is the development of technology for krypton-85, carbon-14, and iodine-129 immobilization and storage. Various methods for containing the gas are being developed. One is compression into bottle-like containers. Another is a process in which the gas is entrained onto a metal surface, which is laid down by a sputtering process through the gas to be entrained. Another process of particular interest for krypton-85 is selective absorption.

The Idaho Operations Office of the DOE has been given lead management responsibility. In the R&D work, all aspects are being considered for monitoring, concentrating, collecting, immobilizing, packaging, transporting, storing, and preparing these gaseous wastes for storage, burial, or disposal for commercial facilities. The goal is to develop a conceptual design for a storage facility for the noble gas krypton-85 by 1981, to develop a capability for monitoring airborne waste streams by 1982, and to demonstrate suitable processes for producing those forms by 1984.

COMMITTEE ACTION

Airborne wastes—$1 million decrease

The Committee reduced the Administration's budget for Airborne Wastes by $1 Million as part of a general reduction to place emphasis upon demonstration repositories for high-level wastes. The resulting budget of $1.8 Million is approximately the same as for 1980. Preparations for containment of krypton-85 that could conceivably be produced by reactor accidents should continue at the planned rate.

HIGH-LEVEL WASTES

e

rch is being done to choose between the various alternative
of immobilizing high-level wastes suitable to provide long-
bility for deep geologic disposal. In addition, methods suit-
full-scale solidification of high-level wastes are being devel-
d demonstrated under the necessary remote-handling condi-
he waste forms and associated overpack canisters are to be
ble with transportation systems being developed by the Trans-
n Technologies Center.

es and scope

level nuclear wastes are predominantly long-lived fission
s which are chemically removed from spent nuclear fuel during
nical extraction cycles used to recover the useful materials re-
in the fuel rods. Small residual amounts of uranium and plu-
are also included. The wastes are initially in a liquid form and
converted into a dry stable form suitable for handling,
tation, and the exacting conditions of safe disposal.
any years, research and development work has concentrated
trified (glass-like) forms of solidified high-level wastes, in-
studies of leaching and of the structural integrity of the glass
ns. In addition, in FY 1979 the spray calcine and ceramic-
glass forming system was used at Hanford, Washington, to
two full-size monoliths of boresilicate glass from spent com-
fuels. One of these will be used for emplacement tests in the
rface Test Facility (NSTF) at the Hanford site in FY 1981.
opment emphasis in 1981 will shift to confirming the proper-
lternate waste forms. These include various synthetic minerals
g the Australian SYNROC mineral form having low waste
ation, "supercalcine" mineral form having higher waste con-
on, and cermat forms.
rough review system has been instituted for materials proper-
Materials Characterization Center is involved in standard-
ests located at Battelle Northwest Laboratories. The Materials
Board located at Argonne National Laboratory will critique
erials Characterization Center and other evaluations. In addi-
road review of materials is being conducted by the Bureau of
ds.
ll supervision of the high-level waste technology program is
avannah River Laboratories, with support by the Transporta-
chnology & Information Center for related transportation

COMMITTEE ACTION

el waste technology—$1 million increased

ommittee approved the budget for high-level waste technology
d by the Administration, however the Committee added $1
for construction of a demonstration solidification facility. To
ze the close relation of solidification and overpack canisters for
ed barriers, the Committee coupled the High-Level Waste
ogy budget with the needed research and development in over-
nisters to encase the solidified monoliths. The Committee speci-

fies the overall budget of both the high-level waste technology and the overpack canister development to be no less than $9 million.

Solidification Demonstration—Section 107(B)(3)(c)

The Committee places emphasis upon providing vitrified monoliths of high-level wastes for use in the technology-demonstration repositories. For this purpose, Project 81-H-03 has been authorized for $1 million to provide a Nuclear Waste Solidification Demonstration Facility. Design, site selection, and preparations for any requirements of the National Environmental Policy Act (NEPA) shall be started in FY 1981 immediately upon passage of the Bill. Construction shall be scheduled for operation to produce glass monoliths by FY 1985 in order to provide the demonstration wastes for the technology-demonstration repositories. Federally owned wastes will be used for this purpose.

The Department should carefully consider the existing forms of federally-owned high-level wastes and any presently-existing adaptable facilities in deciding upon this Waste Solidification Demonstration Facility, in order to assure meeting the completion date of 1985 for the first vitrified monoliths and for economy in construction. Among the considerations should be the following: existing calcined wastes and any existing buildings at the Idaho Nuclear Engineering Laboratory; existing salt-cake wastes and the existing spray calciner and vitrifier at the Hanford site; and existing wastes and any existing buildings at the Savannah River Project. However, new construction should be used instead of any adaption of existing facilities that would cost more, be less safe, or less likely to meet the required completion date for such reasons as facility location, present facility size, present safety conditions, and extent of required reconstruction.

Additional monoliths of solidified wastes can also be provided for the technology-demonstration repositories. These may be of different methods of solidification, as seem appropriate for the demonstration purposes of these repositories.

The Committee approves research work in alternate methods of solidification for uses further in the future than initial loadings in the first technology-demonstration repositories.

However, the Committee places emphasis upon actual demonstrations and tests. The three oversight panels and boards constituted by the Administration for High-Level Waste Technology appear to be excessive. One oversight board or panel should suffice.

WEST VALLEY, N.Y., DEMONSTRATION

Objectives

The high-level liquid wastes at West Valley, New York, are to be extracted from the storage tanks. Wastes are to be solidified on site. Solidified wastes are to be removed for disposal in a repository. Facilities are to be decontaminated and decommissioned. A study is to be made about the economic impact of this activity upon the surrounding communities.

Strategy and scope

Approximately 600,000 gallons of high-level radioactive wastes are currently being stored in underground tanks at the Western New York

Nuclear Service Center in West Valley, New York. The chemical reprocessing plant used to recover uranium and plutonium from the high-level radioactive waste is in a shutdown condition. The commercial operator, Nuclear Fuel Services (NFS), indicated intent to terminate operation at the site at the end of 1980. The State of New York and NSF are co-licensees of the facility. A study to characterize the stored wastes and the West Valley facility, with alternatives and recommendations, has been made by the DOE pursuant to requirements in the FY 1980 appropriations act. Public meetings on plans have been held.

The program in FY 1981 will continue studies and other long-lead activities initiated during FY 1980 which are necessary to define the scope of the project. Included will be characterization of the stored high-level wastes, selection of a waste solidification process system, initial conceptual design of a process system, preparations for supporting NEPA documents, and a program to remove the wastes from the underground tanks. FY 1981 funds are to be used for the following: testing, radiation-monitoring equipment, surveillance, disposition functions, remote handling tools and equipment, breathing support apparatus, pumps, and other associated equipment.

Conditions of the wastes and of the reprocessing cell in which solidification will probably be done are sufficiently different from other previous activities that new developments are required. The previous solidifications performed by the Department on scales as large as pilot demonstrations have been only for acidic wastes from uranium fuel. However, most of the high-level wastes at West Valley are alkaline wastes derived from uranium fuel, although a small part is acidic wastes from thorium fuel. In addition, development of methods are required for removal of the dense sludge layer at the bottom of the high-level waste storage tank, for radioactive decontamination of the reprocessing cell before and after its use for waste solidification, and for radioactive decontamination of the high-level waste storage tank after being emptied.

COMMITTEE ACTION

West Valley, N.Y. demonstration—No change

The Committee added this program in Title I, which was originally placed in Title V of the bill. Both the Committee and the Administration consider the West Valley operation for high-level wastes to be a demonstration operation for waste solidification. The Committee notes that the program was included in Title V of the Administration's proposed budget at the same $5 million level. In authorization hearing testimony, a DOE witness stated that the West Valley demonstration project was included in their category of Remedial Actions (Title V) for accounting purpose only and that it is in fact a research, development, and demonstration project.

The Committee directed that the DOE carry out a high-level liquid nuclear waste management demonstration project at the West Valley, N.Y. site. This is to be accomplished by the solidification of the waste in a technology demonstration facility and the transportation of the solidified waste to a Federal repository for disposal. Methods will be developed for decontamination and decommissioning of liquid high-level waste storage facilities and components. These methods will be demonstrated at West Valley, N.Y. by the decontamination and decommissioning of the facilities, materials and equipment after the solidified waste has been removed. The Committee directed that the wastes at West Valley be acquired by the Federal Government at an appropriate time for final disposal. During FY 81, the Committee directs the DOE to prepare plans for the safe removal of the wastes from the storage tanks and to evaluate techniques for handling and immobilization of the wastes at West Valley.

The Committee approved use of existing funds to study the economic impact of the waste solidification demonstration upon the specified localities nearest to the West Valley facility. Any lack of tax and similar revenue should be considered in this study.

LOW-LEVEL WASTE TECHNOLOGY

Objective

Objectives are to develop technology which can be made available for commercial low-level waste management, to provide assistance and advice to states and other regions for their low-level waste burial grounds, and to consider alternatives to present shallow-land burial of virtually unprocessed low-level wastes. Also, a comprehensive national plan for an adequate number of regional disposal sites for commercial low-level waste management is being planned.

Strategy and scope

Commercial low-level waste is a byproduct of nuclear power reactor operation, medical and industrial uses, and other research and development activities. Typical examples are discarded equipment and metals, filters from the cleanup of gaseous wastes, ion exchange resins from the cleanup of liquid wastes, solids into which has been incorporated liquid wastes, and miscellaneous trash such as paper, rags, glassware, and protective clothing. Some liquid low-level waste is decontaminated and released as non-radioactive materials under controlled conditions.

The lead management role for this task was assigned to the DOE Idaho Operations Office with the associated lead at the DOE Oak Ridge Operations Office. EG&G at the INEL and Union Carbide at ORNL provides technical assistance for management activities. Activities are conducted in concert with the Defense Waste Management Activity.

Three low-level liquid waste purification processes are currently being developed for removal of radioactive contaminants from effluent streams (as alternatives to evaporation). It is planned to demonstrate at least one of these by 1985. Current activities include the investigation of ultrafiltration, selective absorbants, biological concentration processes, and concreting as a method of solidifying sludges. A review is currently underway to select promising alternative disposal techniques for development and field testing. Demonstration of one of these will be completed by the end of 1984.

Water from reactor accidents, such as the Three Mile Island incident, are classified as low-level. The styrene resins from the EPICOR water cleanup system, as well as for the Zeolite resins for the higher-radioactivity water from the containment building, are included.

COMMITTEE ACTION

Low-level waste technology

The Committee has directed that the Secretary conduct research and development on advanced techniques for disposing of low level radioactive wastes. It is anticipated that this will encompass new volume reduction techniques that are to be analyzed in the report also required by the Committee. The Committee authorized a minimum of $2.9 million for these activities.

The Committee moved $0.9 million for low-level waste management operations to Title VII of the bill, since the scope of this activity is broader than R&D alone. The Committee confirmed that this activity is more than just research and development and demonstration and is appropriately in Title VII.

The Committee believes that the existing approach to disposing of low level wastes could be improved. Paragraph 107(B)(6) of the bill, therefore, requires that the Secretary analyze the pros and cons of reducing the volume of the wastes and at the same time glassifying the residue. The Committee recognizes that much of the low level waste is so low in radioactivity that it is adequately safe to simply bury. However, the Committee is concerned that some low level waste has enough radioactivity to adopt a policy of disposing of these wastes in such a manner as to avoid the potential of migration of radioactive elements beyond the disposal site or posing some minimal risk during transportation to the disposal site. In addition the Committee believes it is ill-advised to utilize large tracts of land for burying low level wastes when at small additional expense the volumes can be greatly reduced and the residue removed from the biosphere for any period of possible concern. This paragraph also requires that the Secretary should analyze whether or not the facilities for volume reduction and glassification could be located regionally at nuclear powerplants. Since approximately 40 percent of these wastes originate at these plants, the nuclear facilities could act as a processing point where hospitals, research labs, and industries could send their low level wastes for volume reduction and glassification. The glassified wastes could then be shipped to a licensed disposal facility in the region.

Paragraph 107(B)(6) of the bill requires that the Secretary analyze whether or not the large underground caverns created by nuclear weapon explosions should be considered for possible disposal sites for low level wastes. These caverns at, for example, Nevada, Amchitka, Alaska, Colorado, New Mexico and Mississippi, are already contaminated from the explosions would appear to be an ideal disposal site.

Paragraph 107(B)(6) of the bill requires that the Secretary should analyze whether or not much of the wastes currently classified as low level wastes, like some of the hospital liquid wastes, could be held for a few weeks at the hospital, or until such time as the radioactivity had decayed to background levels, and then disposed of as nonradioactive wastes. This would seem to avoid unnecessary expenses.

The Committee encourages DOE to support the State Planning Council and to other efforts by the states and regions to provide their own burial grounds.

TRANSURANIC WASTE

Objective

Technology is to be developed for safely and economically treating transuranic (TRU) wastes to meet anticipated criteria for long-term isolation. Such technology includes compaction, crushing, digestion or combustion, immobilization of residues, and decontamination of metallic surfaces to reduce waste quantities.

Strategy and Scope

TRU-contaminated solid waste contains transuranic nuclides above a threshold concentration, as measured in nanocuries per gram, derived on the basis of certain natural uranium-containing ores. Wastes below the threshold level are acceptable for shallow burial at controlled sites as low-level waste at one (Hanford, WA) of the 3 currently operating low-level waste burial sites. The proportion of radioactive material to the contaminated waste is minute, both in terms of volume and mass.

Techniques under development include sorting and classifying wastes, mechanical compaction, electropolishing (decontamination), incineration, and immobilization of residues and ashes. By FY 1985, the incineration designs will be documented for availability to industry and a selected incinerator design will be demonstrated for commercial applicability. A non-radioactive demonstration of processing sodium-contaminated wastes from R&D activities will be initiated in FY 1981.

This program is managed by the DOE Albuquerque Operations Office. Rockwell International is providing technical assistance.

COMMITTEE ACTION

Transuranic Waste—$1.1 million reduction

The Committee reduced the Administration's budget by $1.1 million. This results in a budget slightly less than for FY 1980. This decrease results from the importance the Committee is placing upon other activities in waste management, principally the demonstration activities for high-level wastes.

3. SPENT FUEL STORAGE R&D

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses	4,700	6,500			6,500
Program direction	482	513			513
Subtotal	5,182	7,013			7,013
Capital equipment	2,000	1,000			1,000
Construction:					
Authorization		0			
Budget authority	5,000	0			
Total, spent fuel storage R. D		8,013			8,013
Total budget authority	12,182	8,013			8,013

[1] Indicates changes to original fiscal year 1981 budget authority request.

Objectives

The goal of the Spent Fuel Storage R. & D. program is to provide for the safe storage of U.S. and some foreign spent fuel consistent with national nuclear energy goals and U.S. nonproliferation objectives.

The overall objectives of the program are as follows:

To ensure that space is available for the storage of spent fuel so that operation of nuclear power plants within the United States can be maintained.

To support nonproliferation initiatives by offering a credible alternative to nuclear fuel reprocessing by some foreign nations.

The immediate objectives for domestic fuel storage activities include the following:

To plan and manage a program that provides interim spent fuel storage capacity until geologic storage or recovery is available.

To identify and resolve safety and environmental issues and concerns over extended spent fuel storage.

To establish a charge and contract requirements for DOE to provide storage and disposal services.

To develop technology to increase the capacity of existing spent fuel facilities and to develop advanced, improved, high capacity storage technologies.

Strategy and Scope

An essential element of this storage subactivity is the need to transfer spent fuel elements to the storage sites and, eventually, away from these sites when later disposition of the spent fuel is determined. The transportation systems and procedures which are to be employed—storage in privately-owned, or Government-owned AFRs—must be configured and operated not only in a way compatible with the storage facility itself, but also in a manner which complies with regulatory controls governing the movement of all nuclear materials. DOE is charged with assuring that such spent fuel transportation can be accomplished when required as part of its overall nuclear transportation program.

DOE-approved AFR water storage basins will store spent fuel in a retrievable mode. DOE's FY 1981 program plans to provide storage capacity by 1983 consistent with the spent fuel policy approved by the President and the recommendations by the IRG Reort.

Prior to 1983, DOE will consider accepting spent fuel in cases where reactors do not otherwise have sufficient storage capacity.

Status

Many utilities are facing a shortage of adequate spent fuel storage capacity. In some cases, this can be alleviated by more compact racking of their basins. In other cases, transfers of fuel from one basin to another within their own system are possible. While the increased storage basin capacities will provide relief for some utilities, others will face the prospect of inadequate storage. Estimates of the actual transfers which the Government will receive vary significantly.

COMMITTEE ACTION

Spent Fuel Storage R. & D.—No change

The Committee added $8.013 million for Spent Fuel Storage R. & D. This is intended to include under Title I an activity that was originally placed in Title V of the bill.

The Committee also adopted an amendment prohibiting any permanent disposal of spent fuel and any use of funds to prepare for such disposal. Since the once-through fuel cycle extracts a very small fraction of the potential energy of the fuel elements, the Committee believes that any irretrievable disposal of spent fuel is contrary to the national commitment to conversation of energy resources.

The Committee provided $2.5 million under Plant and Capital Equipment for negotiations with the owners of the Barnwell Nuclear Fuel plant at Barnwell, South Carolina. One of the purposes of the negotiations is to obtain use of the spent-fuel storage pool at this plant for use as an Away-From-Reactor (AFR) storage facility, either by lease of the pool and the necessary associated buildings and land or by purchase. This $2.5 million appears and is discussed under Barnwell Nuclear Fuel Reprocessing Facility, IV A1(a).

The Department properly places considerable emphasis on R. & D. leading to establishing contingency storage that could be available for emergencies in 1981–1982. This includes methods for modifying existing facilities for such uses by the middle of calendar year 1981. The Committee endorses these R. & D. preparations so that facilities can be available for contingency storage of fuel from U.S. reactors that would otherwise lose full-core-reserve in their on-site storage capacity.

The Committee particularly encourages the Department in its R. & D. plans to utilize dry storage methods for this contingency storage. Research, development and demonstration should be done for dry storage in existing shielded vaults in the Department's facilities, as well as for advanced techniques of dry storage in caissons and shielded containers.

4. ADVANCED NUCLEAR SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Advanced systems evaluations	2,000	3,000			3,000
Space and terrestrial applications	34,300	37,200	−2,000	−2,000	35,200
Subtotal, operating expenses	36,300	40,200	−2,000	−2,000	38,200
Program direction	1,206	981			981
Subtotal	37,506	41,181	−2,000	−2,000	39,181
Capital equipment: Space and terrestrial applications	2,100	2,800			2,800
Construction:					
Authorization					
Budget authority					
Total authorization		43,981	−2,000	−2,000	41,981
Total budget authority	39,606	43,981	−2,000	−2,000	41,981

[1] Indicates changes to original fiscal year 1981 B/A request.

(a) ADVANCED SYSTEMS EVALUATION

Overview

From the earliest days of the development of nuclear energy, many different reactors and fuel cycles have been considered. During the 1950's and early 1960's, many of these concepts were converted into hardware and tested in an operating environment. These field tests eliminated the least promising ideas, focusing attention on a few technologies which continued to be developed and improved.

There is a continuing need to assess new reactor concepts and their applications, especially as a means of reducing U.S. dependency on scarce fossil fuels. Associated with this activity is the analysis of technical and commercial feasibility, economic and marketplace incentives, resource and environmental impacts, institutional arrangements to facilitate implementation or application of nuclear systems, and other factors associated with evaluating the potential of nuclear power to meet future energy needs. These analyses can form the primary basis for a decision to commit to development and possible demonstration.

Objective

The objective of this effort is to evaluate nuclear power systems, their applications and impacts in support of management decision-making.

Strategy and Scope

As new ideas and concepts are promulgated, they are evaluated initially as to their merits in comparison to existing concepts. Those concepts which survive the initial screening are then analyzed in detail, considering all factors which bear on future acceptability. Upon completion of these analyses and if there is clear reason and need, the concept may enter the development and demonstration phase which requires the commitment of substantial funds. In this phase, the concept is removed from this program and established in its own right as a major development program.

There are two major elements of this program:

1. *Economic evaluations.*—This work is centered on maintaining a data base of economic information on reactors and fuel cycles of interest to management. The data is valuable for monitoring the economic competitiveness and trends of nuclear power generation costs.

2. *Advanced technology and systems assessments.*—This endeavor is primarily directed toward improving the thermal utilization of nuclear power plants, such as use in cogeneration applications for process heat or district heating, and increasing their siting acceptability through such approaches as nuclear energy centers, less water consumptive cooling methods, and the development of methods to predict and mitigate the environmental effects of large waste heat releases.

ECONOMIC EVALUATIONS

Nuclear power is one of the options which a utility can select to satisfy its electrical generation needs. The continued viability of nuclear power depends, to a major extent, on maintaining its economic competitiveness. The Department maintains a data base for capital, fuel, operating, and maintenance costs for both fossil and nuclear plants. This data base serves as a means of comparing differences in costs, monitoring trends in costs, and identifying causes of the continuing cost escalation in both fossil and nuclear plants. Analysis of the data provides a basis for determining what actions, if any, can be taken to alleviate the upward pressure on nuclear electric generation costs.

ADVANCED TECHNOLOGY AND SYSTEMS ASSESSMENTS

A capability is maintained in the area of advanced technology and systems assessments to provide management with comprehensive and timely data with which to make decisions impacting specific nuclear systems, and their applications. This assessment activity is of a continuing nature and structured to evaluate proposed new systems and systems applications, thus providing a basis for selection of those which have the potential of best meeting near- and long-term needs for energy in the United States.

The evaluation function can be categorized into two major areas. The first of these is improving the thermal utilization of nuclear systems through cogeneration for concurrent production of electricity and thermal energy. This area of activity includes comprehensive analyses of process heat generation and utilization (for example, the supply of heat to industrial complexes or for the production of synthetic fuels such as hydrogen) and thermal energy production (e.g., hot water) for heating of metropolitan areas and the means to transmit and distribute this energy. The heating of cities by this method can yield major savings not only in energy usage but in scarce fossil fuels. An example is the Minneapolis/St. Paul area where assessments reveal that approximately 50 million barrels of oil equivalent can be displaced over a 20-year period if district heating is employed.

The second major area of the advanced technology and system assessments activity is in increasing the siting acceptability of nuclear plants. This includes: 1) the evaluation of nuclear energy concepts to determine their effects on land and water usage, costs, control of nuclear fuel and waste handling, and safety of reactor operation; 2) the analysis and testing of advanced power plant cooling concepts designed to decrease water usage and costs of cooling; 3) the evaluation of cooling water availability and future needs to establish where power plants can be sited; and 4) the evaluation of the meteorological impact of large thermal releases from groups of power plants so that future siting can be accomplished with minimal environmental impact, especially if the nuclear energy center concept is employed.

COMMITTEE ACTION

Advanced Systems Evaluation—No change

(b) SPACE AND TERRESTRIAL APPLICATIONS

Overview

In the twenty two years since the first U.S. satellite was launched into space, the Department of Energy (DOE) and its predecessors, the Energy Research and Development Administration and the Atomic Energy Commission, have had a growing role in our country's exploration of space. From a few early earth orbital missions through lunar landings to long-term outerplanetary journeys, the compactness and reliability of nuclear isotope power supplies have been essential to mission success. A primary goal continues to be to support the Nation's civilian space exploration efforts with particular orientation toward National Aeronautics and Space Administration (NASA) missions which depend upon delivery of adequate electrical power while operating in a remote, hostile or specialized environment. A corollary goal of equal significance is a commitment to support the national security interest of the Department of Defense (DOD) in its deployment of satellite systems for navigation and communication in earth orbit.

The first nuclear power supply demonstration in space was the 5.0 pound, 2.7 watts(e), SNAP-3 unit launched on the TRANSIT 4A Navy navigation satellite in June 1961. A SNAP-27 radioisotope heated thermoelectric generator (RTG), averaging 73.6 watts(e), was flown on each of the six Apollo missions to power the Apollo Lunar Surface Experiments Package left on the moon; the missions took place between November 1969 through December 1972.

Since 1961 nuclear isotope power systems have helped assure the success of 18 space missions, including the NASA Pioneers 10 and 11 missions to Jupiter, Saturn and outer space; the Viking I and II Landers on Mars; and several Department of Defense satellites.

In the summer of 1977, nuclear power provided all the electricity for the two NASA Voyager I and II spacecraft which fly by Jupiter and Saturn. These outer planetary missions could not have been accomplished without nuclear electric power.

In the Terrestrial Isotope Applications area the current activities are directed at the development of fuels, materials, and component technology for isotope heat sources and applications for radioactive isotopes such as cesium-137, strontium-90 and krypton-85 from the Nation's backlog of defense nuclear waste. In September 1978, DOE completed construction of a pilot plant irradiation facility for beneficially treating sewage sludge with gamma-rays from cesium-137.

Development of nuclear power for space applications is proceeding to improve thermoelectric conversion material for the static power systems, dynamic isotope power systems for intermediate levels of power demand with 1 to 2 KW(e), and reactor power system technology leading toward the anticipated higher power 10 to 100 KW(e) requirements of potential future NASA and DOD missions.

DOE has initiated two projects for the development of nuclear isotope power systems to supply electrical power to NASA interplanetary spacecraft. The first system is for the NASA Jupiter Orbiter and Surface Probe Galileo Mission, scheduled for launch in early 1984, which will expand upon the Voyager I and II investigations of Jupiter. The second system (a 300-watt (e) RTG) is for the International Solar Polar Mission jointly supported by NASA and the European Space Agency. Two spacecraft are planned to circumnavigate the sun, orbiting in opposite directions about the polar axis. The Solar Polar spacecraft launch is scheduled for early 1985.

To meet the forecasted increasing space power requirements, DOE is developing the technology of a dynamic isotope power system (DIPS) for converting the heat from radioisotopes into electricity by a turbine/alternator system. A dynamic generator is capable of power levels in the 500 to 2,000 watt range required for future U.S. space missions.

To meet power requirements in the 10 to 100 kilowatt range, advanced space nuclear reactor technology is being developed for possible space missions in the early 1990's. High power satellites in geosynchronous orbit and electric propulsion systems for both orbital transfer and planetary exploration missions appears most attractive for nuclear power.

Objectives

The principal objectives of the Space and Terrestrial Systems program are to:

Deliver qualified nuclear-electric systems to other Federal agencies for both outerplanetary space missions and earth-orbiting satellites.

Provide power units for scientific experiments, telemetry, navigation, and communication purposes.

Develop isotope-powered "nuclear batteries" for terrestrial deployment at remote or undersea sites.

Investigate various isotopes and their utilization using the skills developed for the handling and applications of plutonium-238.

Strategy and Scope

The objectives of the program are being met by implementing subprograms in the areas of:

Space Nuclear Systems.
Terrestrial Applications.

Space Nuclear Systems

Objectives

The Space Nuclear Systems subprogram supports other Federal agencies by providing progressively improved nuclear power sources to meet mission objectives.

Development work is undertaken to reduce weight, enhance power levels, improve reliability and mission lifetime.

Strategy and Scope

The work in the Space Nuclear Systems subprogram involves:

Flight systems development, which consists of design, development, qualification, and fabrication of flight-qualified generators.

Power systems technology and support, which includes test and evaluation of materials and components for proposed flight systems and also contains analysis, quality assurance, and reliability support functions.

Isotope fuels, under which plutonium-238 fuel forms and capsule hardware are prepared, fuel assemblies are delivered, and final assembly of the radioisotope heat source is performed.

Space power systems safety, which includes assessments to ensure safe and environmentally acceptable operations leading to flight approvals.

Terrestrial Applications

The current activities comprise the development of fuels, materials, and component technology for: (a) heat sources, and (b) terrestrial isotope applications. Most of the work involves developing beneficial uses and applications for isotopes readily available from defense wastes, the residues remaining from the reprocessing of spent fuel from military reactors—cesium-137, strontium-90, and krypton-85 made available from separations plants in Idaho and Washington.

The Cs-137, Sr-90 and Kr-85 radioisotopes are derived from the reprocessing of military wastes by well-known and developed processes. The Cs-137 isotope decays with a half-life of approximately 30 years and yields a 0.67 Mev gamma radiation output, suitable for disinfection processes.

The Sr-90 isotope is currently available as a fluoride; previous applications of this isotope in the SNAP series of radioisotope generators were made possible by using strontium titanate as the fuel material. The properties and compatibility of the fluoride alternative material are being developed to enable near-term licensability and use of the fluoride fuel capsule.

Objectives

This work involves:

Application of the gamma radiation available from the cesium-137 isotope to irradiation of sewage sludge so as to disinfect the product and demonstrate its utility as fertilizer, soil conditioner, cattle feed, etc.

General studies on the beneficial utilization of isotopes recoverable from reactor waste streams.

Strategy and Scope

The objectives are being attained by using the resources of the national laboratories and selected contractors where the necessary skills are available.

COMMITTEE ACTION

Space and Terrestrial Applications—$2 million decrease

This program has been reduced because of budget constraints. Reduced funding will slow down development of the power source for the solar-polar satellite project.

5. BREEDER REACTOR SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Liquid metal fast breeder reactor	481, 300	222, 669		+239, 820	462, 489
Water cooled breeder	60, 400	62, 400	−800	−19, 800	42, 600
Gas cooled breeder reactor	19, 988	0			0
Fuel cycle R. & D	18, 600	9, 000		+9, 000	18, 000
Subtotal operating expenses	580, 280	294, 069	−800	+229, 020	523, 089
Program direction	11, 398	11, 181			11, 181
Subtotal	591, 678	305, 250	−800	+229, 020	534, 270
Capital Equipment:					
Liquid metal fast breeder reactor	22, 021	10, 500		+5, 200	15, 700
Water cooled breeder	2, 100	1, 200			1, 200
Gas cooled breeder reactor	1, 500	0			0
Fuel cycle	2, 500	400		+3, 000	3, 400
Subtotal, capital equipment	28, 120	12, 100		+8, 200	20, 300
Construction:					
Authorization		66, 500		+15, 700	82, 200
Budget authority	122, 512	66, 650		+13, 700	80, 350
Total:					
Authorization		383, 850		252, 920	636, 769
Budget authority	742, 300	384, 000		250, 920	634, 920

[1] Indicates changes to original fiscal year 1981 B/A request.

(a) LIQUID METAL FAST BREEDER REACTOR

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Plant projects:					
Fast flux test facility	76, 200	66, 000		+10, 000	76, 000
Clinch river breeder reactor	172, 400	0		+155, 000	155, 000
Breeder reactor studies	15, 000	7, 500			7, 500
Subtotal, plant projects	263, 600	73, 500		+165, 000	238, 500
Breeder technology:					
Safety	36, 500	23, 350		+15, 650	39, 000
Components	42, 000	15, 879		+22, 130	38, 009
Physics	9, 000	6, 827		+3, 700	10, 527
Fuels and core materials	46, 000	24, 454		+21, 000	45, 454
Materials and structure	8, 900	9, 459		+540	9, 999
Subtotal, breeder technology	142, 400	79, 969		+63, 020	142, 989
Test facilities:					
ANL facilities	35, 823	34, 800		+1, 900	36, 700
ETEC facilities	21, 050	16, 000		+6, 000	22, 000
General support	3, 187	1, 000		+4, 100	5, 100
HEDL facilities	7, 440	13, 700		−5, 100	8, 600
INEL facilities	7, 800	3, 700		+4, 900	8, 600
Subtotal, test facilities	75, 300	69, 200		+11, 800	81, 000
Subtotal, LMFBR	481, 300	222, 669		239, 820	462, 489
Capital equipment:					
Plant projects	3, 361	3, 400			3, 400
Breeder technology	6, 639	3, 100		+5, 200	8, 300
Test facilities	12, 021	4, 000			4, 000
Subtotal, capital equipment	22, 021	10, 500		+5, 200	15, 700
Construction:					
Authorization		66, 500		+15, 700	82, 200
Budget authority	111, 600	66, 650		+13, 700	80, 350
Total:					
Authorization		299, 669		260, 720	560, 389
Budget authority	614, 921	299, 819		258, 720	558, 539

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

Since 1976, two factors have influenced the Administration to slow the LMFBR program: a resassessment of the timing of the need for the breeder, and increased concern for the proliferation issue.

The timing reassessment is based on substantial reductions in projected demand for nuclear generating capacity: the Administration's current projection for the year 2000 is 150–250GWe. In 1976, the year 2000 nuclear capacity was projected to be 625 GWe. In addition, the Administration's estimated uranium resource base has been revised upward. Thus, the Administration has concluded that deployment of the breeder may not be required until 2020 at the earliest.

The Aministration has proposed that, with more time available, the U.S. can reduce its efforts on LMFBR research and development to a more deliberate pace. Efforts are being paced to retain a base of data for use in making a future decision on whether to proceed with further demonstration of the technology.

Objective

The current Administration objective of the LMFBR program is to maintain a resource of technology information on the LMFBR concept at a level sufficient to provide the basis for a future decision on whether to proceed with further plant development and deployment.

Strategy

Based on the assumption that the LMBFR will not be needed before the year 2020, the Administration has proposed that the LMFBR program be consolidated around the operation of the Fast Flux Test Facility (FFTF) reactor and associated support programs.

The LMFBR program is composed of three elements:

Plant Projects;
Breeder Technology; and
Test Facilities.

Current plant projects include the FFTF, the Clinch River Breeder Reactor Plant and a developmental plant conceptual design study. R&D efforts in safety, components, physics, fuels and core materials, and breeder fuel reprocessing constitute the breeder technology element. The third element, test facilities, covers the operation and maintenance of facilities required by the projects and breeder technology efforts.

(1) Plant Projects

The existing power plant developmental projects are:

Fast Flux Test Facility (FFTF);
Clinch River Breeder Reactor (CRBR) plant; and
Developmental Plant Conceptual Design Study (CDS).

The FFTF is a reactor at Hanford, Washington, at the Hanford Engineering Development Laboratory which will be used as a fuels and materials test facility. The CRBR is a joint government-industry effort on a 380-gross-megawatt electrical demonstration breeder reactor power plant at Oak Ridge, Tennessee proposed for termination by the Administration. The CDS is directed toward a conceptual design of the developmental plant now perceived as the next logical step in the demonstration of the LMFBR concept should a decision be made to do so.

Fast Flux Test Facility (FFTF)

A high-priority part of the breeder reactor program is the completion of the Fast Flux Test Facility and its subsequent operation. The FFTF is a 400 thermal megawatt sodium cooled fast neutron flux reactor designed specifically for irradiation testing of fuels and materials for LMFBRs. It is located at the Hanford Engineering Development Laboratory in Richland, Washington. Construction on FFTF was completed and criticality achieved in February 1980.

Objective

The FFTF will serve as an advanced fast-flux test bed for advanced and alternative fuels and materials experiments needed to continue DOE advanced reactor development programs; and as a baseline for scaling plant systems and components to the larger sizes.

Strategy and Scope

In fulfilling its prime role of providing a test bed for demonstrating and evaluating the performance of future LMFBR-plant fuel assemblies and core designs at reference conditions, the FFTF will be used:

To test fuel elements up to and including failure under dynamic sodium-flow conditions in order to establish ultimate capability and failure modes—an understanding of failure modes is essential to establish LMFBR core safety, reliability, performance, and lifetime;

To develop the advanced fuels and advanced cladding and duct materials essential to attaining operational breeding ratios in the 1.25 to 1.45 range with fuel doubling times of less than 15 years;

As a prototype irradiation test bed for various fast reactor fuel and blanket materials considered in the nonproliferation fuel cycle studies; and

To obtain experience in the operation of an LMFBR having coolant loops and components at operating conditions typical of large LMFBR power plants.

Although FFTF, as a test reactor, was not designed to breed or to produce electricity, it has provided and will continue to provide valuable information to follow-on LMFBR projects and base technology programs in the area of:

Plant system and component design;
Component fabrication;
Prototype testing; and
Site construction.

As part of its reduced emphasis on Breeder Reactor programs, the Administration has proposed a reduced testing program at the FFTF.

Clinch River Breeder Reactor (CRBR) Plant

The Administration has proposed that the Clinch River Breeder Reactor (CRBR) plant project be terminated. Implementation of the proposal is pending final resolution by the Administration and Congress.

Objective

The currently authorized objectives of the CRBR Project are to design, license, construct and test a 380 MWe liquid sodium cooled breeder reactor demonstration plant and to operate the plant as part of a utility system.

Strategy and Scope

Pending legislation authorizing termination of the project, engineering, fabrication, and support activities have continued on a reasonable and prudent basis. Projects status at the end of FY 80 is as follows:

The engineering activities of research, development, and design are projected to be 78 percent complete.

The costs incurred on contracts are estimated to be approximately $320 million.

Approximately $967 million will have been invested in the project, including about $856 million of DOE funding and $111 million of funding by utilities and other participants.

The Final Environmental Statement, the Site Suitability Report, and Design Criteria issuance have been obtained from the Nuclear Regulatory Commission.

Licensing proceedings necessary to secure the Limited Work Authorization were suspended on April 25, 1977.

Breeder Reactor Studies

A key element in assuring viability of the LMFBR program in the U.S. is the performance of a Conceptual Design Study (CDS). The CDS, a key element in developing LMFBR options for the future, is a totally government funded and managed effort incorporating input and experience from industry and the utilities. The study is based on evaluations and optimization of overall plant safety, environmental acceptability, proliferation resistance, economics, and reliability, and will provide information that can be utilized as part of a decision process to determine if and when an LMFBR plant larger than FFTF should be built.

Objective

The CDS will prepare a conceptual design of an LMFBR developmental plant by March 31, 1981. It will also provide a partial focus for the LMFBR base technology program and provide a logical next step in the U.S. program while maintaining U.S. LMFBR expertise.

Strategy and Scope

The CDS is being conducted in two phases. The first phase, of 18 months duration, which was completed in March 1980, consisted of:

Trade-off studies of basic plant design alternatives (e.g., pool vs. loop configuration for the primary heat transport system, steam cycle characteristics, etc.);

Identification of system design improvements and simplifications;

Development of safety and licensing criteria;

Specification of system requirements for major components;

Identification of preliminary R&D requirements; and

Compilation of summary principal plant design requirements and criteria.

The second phase consists of 12 months of plant conceptual design effort based on the design selections from Phase I. Phase II efforts include:

Description of the developmental plant conceptual design;

Preliminary estimates of costs and schedule durations for design and construction of the plant;

A description of the required R&D to support the developmental plant;

Proposed institutional arrangements for proceeding with the plant; and.

Description of the role of the developmental plant within the overall LMFBR program.

A report documenting the results of the study will be completed by March 31, 1981 and will provide information useful in determining the future strategy of the LMFBR program.

(2) Breeder Technology

The breeder technology program, which provides engineering information and technology support for LMFBR plants and facilities, will increase the safety and reliability, reduce the cost, and facilitate licensing of future plants and facilities. In addition to the general development of breeder technology, the program will provide contingency alternatives to critical items. The scope includes technology in the areas of:

Safety,
Engineered Systems and Components,
Physics,
Fuels and Core Design, and
Materials and Structures.

Safety

To attain and demonstrate the required degree of safety for fast breeder reactors without unacceptable economic penalties, a sound frame of technical reference is required for assessing the risk to public health and safety from postulated accidents with the full spectrum of breeder reactor designs and fuel cycles being considered.

Objective

The objective of the safety program is to demonstrate that even highly unlikely reactor accidents will pose no significant hazard to the public. Thus a technology base is being developed that is fully responsive to safety consideration in the design, evaluation, licensing, public acceptance, and economic optimization of breeder reactor systems for electrical power generation.

Strategy and Scope

A major reactor accident cannot take place unless a sequence of failures occurs within the reactor system. The safety goal is being achieved by developing technology in four generic and integrated segments each of which relates to a sequential barrier preventing accident progression, thus preventing release of any significant amount of radioactivity to the environment.

Engineered Systems and Components

The Engineered Systems and Components program, which is largely independent of fuel and fuel-cycle types, and thus of the nonproliferation issue, includes CRBR and alternative-component design, fabrication, and testing and the development of supporting technologies.

Objective

The objective of this program is to develop the steam generator, pumps, and other components for the LMFBR reactor system, and to develop sodium and instrumentation and control technologies.

Strategy and Scope

A review in 1974 by reactor manufacturers, national laboratories, and utilities resulted in a consensus that the base-technology program underway at that time needed better balance and, in particular, that it should be strengthened in areas that would reduce uncertainties in component performance and plant capital costs to levels acceptable to utilities and reactor manufacturers. As a result, a vigorous component development and testing program was planned and launched in 1975. To provide the technology for reliable and economic equipment, models of critical components applicable to future breeder reactors are designed, fabricated, and tested, confirming the feasibility of the design for large plant application. Primary emphasis is on the development of steam generators and large pumps. Methods for monitoring and controlling sodium impurities and processes for sodium removal and decontamination are being developed. Instrumentation and controls of enhanced reliability and accuracy are being developed to enhance plant availability.

Physics

The physics program is directed toward developing and maintaining a generic physics design and analysis compatibility based on and including supporting the operations of FFTF.

Objective

The objective of the physics program is to provide measurements, nuclear data and computational methods as required to assure safe and effective operation of LMFBR reactors.

Strategy and Scope

The physics program provides experimental measurements of core and shield properties, nuclear data measurements and evaluations, and development of computational methods for predicting core performance, shield effectiveness and safety parameters. These activities support the available options for fuel forms, reactor types, and nuclear fuel cycles, as well as U.S. participation in international technical exchanges. Emphasis is placed on analysis of the FFTF neutronic performance and changes due to core reload requirements. State-of-the-art experimental and analytical physics support is provided for determination of the radiation doses utilized in fuels and materials irradiation test programs.

Fuels and Core Design

This work identifies and develops breeder reactor fuel, blanket and absorber elements, and demonstrates their performance capabilities under steady-state and design-transient conditions. It includes developing fuel fabrication equipment and processes as well as analytical design and performance models, and verifying the models by various levels of irradiation testing.

Objective

Fuel and core materials major objectives are to determine and improve the lifetime of FFTF replaceable core components such as fuel and absorber assemblies, and provide fuel fabrication capabilities for continuing operation of FFTF, and also to design, develop, and qualify through FFTF testing advanced fuel, blanket, and absorber assemblies.

Strategy and Scope

The fuels and core materials program comprises two parallel activities: (1) the confirmation of previous development work on reference FFTF fuel-system materials (i.e., U/Pu oxide fuel and Type-316 stainless steel cladding and ducts) to support the safe and reliable operation of FFTF as a test reactor, and (2) the performance of sufficient EBR–II, TREAT, and FFTF based investigations, as well as fabrication development activities, on advanced fuels, blanket and absorber concepts to narrow the options to the point where prime concepts can be selected and developed. The development work is organized into three elements:

Fuels, absorbers, and clad/duct materials for FFTF;

Advanced fuels, blankets, absorbers and clad/duct materials; and

Fuel fabrication processes.

The program depends heavily on irradiation tests conducted in the EBR–II reactor and to be conducted in the FFTF. The fuel fabrication process development efforts focus on the Zero Risk Fuel Fabrication (ZRFF) program. Partial demonstration of the ZRFF technology will be accomplished in the Fuels and Materials Examination Facility (FMEF).

The current methods for handling, fabricating and processing plutonium-bearing fuels utilize hands-on glove box techniques that have attendant possibilities of personnel radiation exposure, contamination, and diversion or release of plutonium. These methods cannot achieve essential goals when processing large quantities of plutonium.

These fundamental goals are to minimize personnel exposure, contamination and release to the environment and to minimize personnel accessibility and diversion potential, coupled with maximizing safeguards and accountability, quality, reproducibility, cost effectiveness and non-proliferation requirement. These goals are achievable through the development and implementation of technology that results in the use of automated equipment and processes that are remotely operated and maintained when processing plutonium. The technology development for achieving these goals through automared and remotized operations, from the receipt of materials through finished fuel pins, is now under way. Dramatic demonstrations of certain key unit operations have already been completed. Additional work on remaining unit operations, plus integration of all operations into an efficient operational automated SAF fuel line remains to be done.

Materials and Structures

The Materials and Structures program consists of the development of materials and design technologies for non-core related LMFBR applicatioins.

Objective

The objective of this program is to develop the materials and design technologies needed to support component development and improve the safety, reliability, economics and licensability of LMFBR's.

Strategy and Scope

Due to the sodium and high temperature environment, the LMFBR involves unique engineering problems in terms of materials applications and structural design. To address these problems and reduce uncertainties, programs are under way to improve the technological base in the areas of seismic and high temperature structural design, fabrication, inspection methods, and materials behavior including short- and long-term materials properties, friction and wear, and environmental effects.

(3) Test Facilities

Reactor test facilities provide support and are an essential part of the Fast Breeder Reactor Program. This category of activity includes the operation and maintenance of existing test facilities. It also includes certain facility management and operating activities for safeguards systems at Argonne National Laboratory (ANL), Hanford Engineering Development Laboratory (HEDL), and Idaho National Engineering Laboratory (INEL), and landlord support at HEDL, INEL, and the Energy Technology Engineering Center (ETEC).

Objective

The objectives of this program element are to (1) operate and maintain existing test facilities, conducting tests in accordance with schedules established by the breeder technology and plant projects program elements; (2) acquire new facilities as required to support FFTF operation; (3) provide construction and operational services for nuclear material safeguard systems and perform landlord functions at selected DOE sites; and (4) assure that nuclear programs are carried out using proper standards, quality assurance techniques and safety practices.

Strategy and Scope

Existing test facilities are operated, modifications to existing facilities are carried out and new facilities are provided in support of the breeder technology and plant projects elements of the LMFBR program in accordance with technical requirements, priorities and schedular needs identified under those elements.

Nuclear materials safeguard systems are being improved at Argonne National Laboratory (ANL), the Hanford Engineering Development Laboratory (HEDL), and the Idaho National Engineering Laboratory (INEL); landlord support is provided at these three sites and at the Energy Technology Engineering Center (ETEC). The landlord activities include providing various general site services, providing general purpose equipment (GPE), constructing general plant projects (GPP) and line item construction projects for general purpose facilities and certain other multi-program projects, and preventing deterioration of site support facilities, systems, and equipment. Landlord activities are conducted by the major operating contractors at each of the four sites, using subcontractors selected by competitive bidding for the larger construction projects.

The test facilities element also includes a program assurance activity which support continuing operation of the Nuclear Quality Assurance Program Offices at ANL and HEDL. The element also supports facility fire inspections and information transfer and assessment activities.

The major existing and operating facilities and the elements of the LMFBR program that they support are listed below, grouped by the laboratory or engineering center where they are located.

Laboratory	Facility	Technology element
Argonne National Laboratory (ANL)	Experimental breeder reactor II (EBR–II)	Fuels and core design.
	Hot fuel examination facility (HFEF)	Fuels and core design.
	Transient reactor test (Treat) facility	Safety.
	Zero power plutonium reactor (ZPPR)	Physics.
	Zero power reactors 6 and 9 (ZPR–6 and 9)	Physics.
Energy Technology Engineering Center (ETEC)/	Thermal transient facility (TTF)	Materials and structures.
	Sodium components test installation (SCTI)	Components.
	Sodium pump test facility (SPTF)	Components.
	Large leak test rig (LLTR)	Components.
	Small components test loop (SCTL)	Components.
Hanford Engineering Development Laboratory (HEDL).	High temperature sodium facility (HTSF)	Components.
	Hydromechanical facilities	Fuels and core design.
Idaho National Engineering Laboratory (INEL)	Engineering test reactor (ETR)	Safety.

COMMITTEE ACTION

Plant Projects—$165 million increase

The Administration request contained no funds for the Clinch River Breeder Reactor Project (CRBR). The Subcommittee added $155 million to provide minimum funding for the CRBR to continue the engineering design effort and development of prototype and plant hardware and procurement of certain components already under fabrication. The Secretary was also directed to take all appropriate actions necessary to prepare for resumption of licensing of the CRBR including, but not limited to, officially requesting the Nuclear Regulatory Commission (NRC) to resume the technical staff review of generic safety and related environmental issues. There is insufficient funding authorized to commence site preparation in this fiscal year. The CRBR funds also include up to $15 million for a Joint Plant Design Activity with the United Kingdom. This Joint Study will draw as much as possible upon the existing technical team, design information, and data base of the CRBR Project as well as those key elements of the LMFBR base program. It is expected that the CRBR project will develop specific plans for the Joint Study by no later than January 1, 1981. CRBR funds not planned for expenditure on the Joint Study will automatically be applied to CRBR. To the extent that the Joint Study reflects a desire to attain international cooperation on future breeder reactors, it should also incorporate the results of the Conceptual Design Study.

The Committee increased funding for the Fast Flux Test Facility by $10 million. A full testing schedule for the Fast Flux Test Facility (FFTF) will be maintained and the staff of scientists and engineers kept intact. In addition, continued, efficient use of the test facilities will be funded. Test facilities are an important part of the base breeder program and include test reactors and special facilities needed to examine hot fuel and for engineering component development and breeder safety research.

Breeder Technology and Test Facilities—$95.72 million increase.

The Administration proposed severe cuts in the Breeder Base Program, which would have crippled our ability to develop this important energy source and destroyed the technical community that has taken so many years to build.

Breeder Technology

The Subcommittee added $68.22 million in operating expenses and capital equipment for Breeder Technology.

Major increases in Breeder Technology are:

Safety—$15,650,000 increase.—Will permit full scale testing at the TREAT facility and continuation of the reactor analysis work at Argonne National Laboratory.

Components—$22,130,000 increase.—Will permit continued development of the double-walled steam generator and the reference intermediate pump, and the general engineering support and instrumentation and control activities.

Physics—$3,700,000 increase.—Will permit continued work at Battelle National Laboratory and Argonne National Laboratory on heterogeneous core, control rod anomalies and analysis of critical experiments at the ZPR reactors.

Fuels and Core Materials—$21,000,000 increase.—Will permit continued development and testing of carbide and advanced oxide fuels as well as support for post irradiation testing of EBR II and FFTF tests.

Materials and Structures—$540,000 increase.—Modest increase needed to maintain development and testing of materials.

Capital Equipment—$5,200,000 increase.—Will permit continued development of fuel transfer cask for FFTF as well as other items.

These funds are necessary to continue development of this technology with the potential to makea decision on commercialization in the 1990's.

With the increased funding, development of our ability to ultimately commercialize breeder technology will continue. This activity is the backbone of our breeder program.

Included in Breeder Technology are operating funds to be used in the development of secure automated fabrication of plutonium-bearing fuels. The fundamental goals are to minimize personnel exposure, contamination and release to the environment and personnel accessibility and diversion potential, coupled with maximizing safeguards and accountability, quality, reproducibility, cost effectiveness and nonproliferation requirements.

The Committee added $10 million to Project 78-G-f (described in Section M2.(f)(2) of this report) specifically to increase the scope of the project to include development of a Secure Automated Fabrication (SAF) line.

Test Facilities

The Administration had proposed reduced operating funds for test facilities, primarily in the activities at the Energy Technology Engineering Center (ETEC). The Committee added sufficient funds to permit a balanced testing program at all of the test facilities. The additional funds will permit continued operation of the Large Leak Test Rig and the Sodium Component Test Installation at ETEC. The program will include testing of CRBR prototype steam generators and sodium pumps as well as the effects of large steam generator leaks. In addition, the Committee added $7,400,000 in plant and capital equipment authorization to Project 78-6-e (see section M2.(f)(5) of this report). These funds will permit Phase B modification of the Sodium Pump Test Facility to proceed toward the testing of large sodium pumps, up to 100,000 gpm that will be needed for 1,000 MWe and larger breeder reactors.

In addition, the Committee reduced authorization for General Plant Projects (Project 81-T-310) by $3,500,000 in plant and capital equipment because of budgetary constraints. The Committee added $1,000,000 in authorization for Support Services building (Project 81-T-311) at Hanford Engineering Development Laboratory and $800,000 in authorization for a General Plant Project (Project 81-T-312) for radioactive waste discharge control at Idaho National Engineering Laboratory. These changes are discussed in section M2.(f) of this report.

(b) WATER COOLED BREEDER

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Advanced water breeder applications (AWBA)	14,400	19,800		−14,800	5,000
Light water breeder reactor	30,900	29,000		−5,000	24,000
Shippingport Atomic Power Station (PWR)	12,600	11,000			11,000
Proof of breeding (fuel cycle R. & D.)	2,500	2,600			2,600
Subtotal, operating expenses	60,400	62,400	−800	−19,800	42,600
Capital equipment: Water cooled breeder	2,100	1,200			1,200
Total	62,500	63,600	−800	−19,800	43,800

[1] Indicates changes to original fiscal year 1981 B/A request.

The purpose of this program is to develop technology to improve significantly the utilization of nuclear fuel resources for the generation of electric power by water cooled nuclear reactors.

Successful development of a water cooled breeder using the thorium/uranium fuel cycle would make available for power production about 50 percent of the energy potentially available in thorium reserves, a source of energy many times greater than known fossil fuel reserves. This is the only known approach using light water cooled reactors that can make available for power production significantly more than one or two percent of the energy potentially available in nuclear fuel reserves.

Overview

For the WCB program, this section summarizes the background, objective, strategy and scope, participants, and program funding.

Background

In the early 1960's, the Knolls and Bettis Laboratories, under the direction of the Naval Reactors Division, determined that it might be possible to develop a practical self-sustaining breeder cooled with ordinary light water and fueled with uranium-233 and thorium. As light water technology has been demonstrated to be practical in nearly 20 years of experience, the principal development necessary is the breeder core itself, permitting developmental efforts to concentrate on the breeder core technology. Such a breeder would have the advantage of using the well established technology of light water reactors, which is the basis of the present commercial nuclear power industry. This early work led to the establishment of the Light Water Breeder Reactor (LWBR) program in 1965.

Objective

The immediate objective is to confirm that breeding can be achieved in existing and future light water reactor systems using the thorium/uranium-233 fuel system. The LWBR concept has the potential of significantly increasing the amount of useful energy that can be produced from our nuclear fuel reserves using water cooled reactors. One measure of this potential is the reduction in the amount of uranium that must be mined to produce a given amount of useful energy.

An LWBR core has been developed, designed, fabricated, and installed and is now operating in the DOE-owned pressurized water reactor plant of the Shippingport Atomic Power Station at Shippingport, Pennsylvania. It is expected that the core will be operated another two to three years, after which it will be removed and the spent fuel will be shipped to the Naval Reactors Expended Core Facility in Idaho for detailed examination and determination of breeding performance. It is expected that the expended core will contain about 1 percent more fissionable material than the initial fueling.

The Advanced Water Breeder Applications (AWBA) program was initiated in FY 1976 with the objective of developing and disseminating technical information to assist U.S. industry in evaluating the LWBR technology and in deciding if, when, and how it can be applied to their programs. The AWBA program explores some of the technical problems that will be faced by industry in adapting technology developed in the LWBR program. The focus of this program is on developing technical information and then promptly disseminating it.

Reprocessing and refabrication work associated with the light water breeder reactor concept is not included in the Water Cooled Breeder program. Such work is under the cognizance of the DOE Division of Nuclear Power Development.

If it is assumed that a current commercial light water reactor with a plant electrical output of 1,000 MWe requires about 130 tons of uranium ore concentrate (U_3O_8) per year, and that such a plant lasts for 40 years, then 5,200 tons of U_3O_8 would have to be mined, milled and enriched to fuel the plant over its lifetime. An additional 5,200 tons of U_3O_8 would have to be mined to fuel a replacement plant over its 40-year lifetime, and so on.

Preliminary studies show that, using the LWBR concept, it might be necessary to mine only about 3,000 tons of U_3O_8 to make enough uranium 233 in prebreeder cores to fuel a 1,000 MWe breeder. Once enough uranium 233 is accumulated to put a light water reactor on the breeding cycle, the increment of electrical capacity represented by that recator would become self-sustaining without further mining or enrichment of uranium. The only makeup fuel required would be small amounts of thorium. Thus, each increment of capacity using the LWBR concept instead of present types of commercial light water reactors would reduce the long term uranium mining and enrichment requirements.

Strategy and Scope

The Water Cooled Breeder fuel cycle is based on the use of thorium and uranium 233 and consists of two phases:

Prebreeder phase: U–235 or other fissile material would be used to fuel light water reactors that would also contain thorium. Operation of these reactors would produce fissile U-233 from the thorium while providing power for generating electricity.

Breeder phase: U-233 produced in the prebreeder reactors would be used to fuel breeder reactors that are expected to be self-sustaining—that is, they would produce enough fissile fuel to replace the fuel used in generating electricity and require no mining or enrichment of uranium for fissile fuel makeup.

The work to achieve the goal of the Water Cooled Breeder program involves:

The Shippingport Atomic Power Station (PWR) program—the continued operation and testing of the station.

The Light Water Breeder Reactor (LWBR) program—the development, manufacture, operation, testing, examination and evaluation of the Shippingport LWBR core.

The Advanced Water Breeder Applications (AWBA) program—the development and dissemination of technical information on the LWBR concept.

(1) Shippingport Atomic Power Station

The Shippingport Atomic Power Station, 25 miles northwest of Pittsburgh, Pennsylvania, was the first large-scale central station nuclear power plant in the United States and the first plant of such size (initial operation 60 MWe net) in the world operated solely to produce electric power. The project was started in 1953 by the U.S. Atomic Energy Commission (now DOE) to confirm the practical application of nuclear power for commercial purposes. Initial criticality of the first Shippingport reactor core was achieved December 2, 1953. Operation of the Shippingport plant with pressurized water reactor cores has provided much of the technology for designing and operating the commercial central station nuclear power plants now in use.

Objectives

The objective of the Shippingport Atomic Power Station is the advancement of pressurized water reactor basic technology, including the development and testing of advanced reactor concept. Operating the plant is expected to provide valuable information not only on the useful life of the core, but also on the long term performance of all aspects of light water reactors, their systems and components. Following removal of the LWBR core, the Shippingport reactor plant will be turned over to the DOE Office of the Deputy Assistant Secretary for Waste Management for disposition. This work will not be done or budgeted under the Water Cooled Breeder program.

Strategy and Scope

The Shippingport Atomic Power Station reactor plant will operate for another two to three years with the LWBR core.

(2) Light Water Breeder Reactor

The LWBR was established in 1965 to develop a breeder reactor core using light water as a moderator and coolant.

Objective

Operation of the LWBR core at Shippingport is being conducted primarily to accomplish three objectives:

Prove that breeding can be achieved in a light water reactor nuclear power plant using a thorium/uranium–233 fuel system;

Confirm a practical way to obtain energy from thorium; and

Show that a light water breeder reactor core that uses thorium fuel can be installed in a pressurized water nuclear power plant using the same type of pressure vessel, pumps, heat exchangers, piping systems, etc., as are used in commercial pressurized water reactors (PWRs).

Strategy and Scope

The LWBR program encompasses development of the technologies required for the successful design, fabrication, operation, testing and examination of a breeder reactor, including:

Support of the operating and testing of the LWBR core presently installed in the Shippingport Atomic Power Station.

Preparation for removal, shipment, and examination of the expended LWBR core.

Development of an improved understanding of the nuclear and materials characteristics of the thorium/uranium 233 fuel system in light water reactors;

Analytical and experimental development supporting performance capability of zircaloy-clad thorium based oxide fuel.

(3) Advanced Water Breeder Applications

The Advanced Water Breeder Applications (AWBA) program was initiated in FY 1976 as part of the Water Cooled Breeder program to develop and disseminate technical information that will assist U.S. industry in evaluating Light Water Breeder Reactor technology and applying it to their programs.

Objective

The Advanced water breeder applications (AWBA) program's objective is to develop and disseminate technical information to assist U.S. industry in evaluating LWBR technology and deciding if, when, and how it can be applied to their own programs. Additional development work is necessary to allow U.S. industry to decide the degree to which they want to adopt LWBR technology. The focus of the AWBA program is on exploring technical problems, and developing and disseminating technical information through published technical reports. This effort is not an attempt to commercialize this technology, but rather is a research and development effort that does not involve any commitment to commercial deployment, nor any significant commitment of industrial capacity or funds which could generate undue pressure for deployment.

Strategy and Scope

The program explores the technical problems that will be faced by industry in adapting technology confirmed in the Light Water Breeder Reactor program. The focus of this program is on first developing technical information and then promptly disseminating it.

Status and Current Activities

The major efforts being conducted under the AWBA program are:

methods for producing the U–333 needed for breeder reactors;

methods to improve breeding, engineering component development and testing;

the conceptual design of commercial size prebreeder and breeder reactors.

The primary emphasis within the AWBA program is on the design and development of improved methods for producing U–233 in water cooled prebreeders and improving breeding in water cooled breeder reactors. Areas requiring further development for the uranium-233/thorium fuel systems include: reactor design concepts; general development, such as, reactor mechanical design and fuel element design; and fuel fabrication process technology. Irradiation test programs will also be conducted in support of the AWBA program. During FY 1981 conceptual design work on large scale breeder reactors using and extending technology developed during fabrication and operation of the Shippingport LWBR core, will continue. Also, work on development of advanced breeder control concepts will continue. These concepts are expected to provide necessary reactor control while minimizing neutron losses and without substantial increases in power peaking.

General development efforts to support uranium-233 fuel systems in water reactors will include: evaluating fuel rod performance for prebreeders and breeders; developing improved analysis methods to carry out physics, fuel element, and thermal/hydraulic performance evaluations; continuing development of clad and fuel materials for performance assessments; and evaluating fuel element pellet geometries and compositions. Fuel fabrication process technology development will continue to evaluate means to simplify and improve the uranium 233/thorium fuel fabrication process. Reactor mechanical design efforts will include continuing development of a close-spaced, triangular-pitch, zircaloy grid fuel rod support system and performing preliminary component, thermal/hydraulic, and vibration tests of a thoria finger control system. An irradiation test program to provide data on the effects of higher power and rod pressurization and to improve stress corrosion cracking performance of thoria-urania fuel systems will continue. This will include: conducting short and long rod screening irradiation tests; testing of a prebreeder bundle; and, completing design of a second bundle test.

(4) Proof of Breeding

This program supports the Naval Reactors Division's work to develop a Water Cooled Breeder (WCB). In the WCB program, a Light Water Breeder Reactor (LWBR) core is being tested in the reactor of the Shippingport Atomic Power Station. After that core is removed in 1982, its fuel will be analyzed to determine whether the LWBR core has indeed "bred" fuel—i.e., converted thorium to fissile uranium-223, at a rate at least equal to fuel consumption. Thus, this LWBR Proof of Breeding (LWBR–POB) analytical program is performing precision wet chemical analyses that will aid in selecting and calibrating nondestructive assay devices (NDA) that Bettis Atomic

Power Laboratory (BAPL) will use to measure whether breeding was achieved. Laboratory work on the project has proceeded through the equipment and methods development stage. Prototype equipment for fuel cutting and dissolution has been installed and is being tested in a hot cell at Argonne National Laboratory (ANL).

Objective

This work supplies the chemical analyses of irradiated fuel rods required for calibrating and verifying the performance of the Irradiated Fuel Assay Gauge (IFAG) being devised by the Bettis Atomic Power Laboratory (BAPL) to determine the breeding (fissile fuel content) of the Shippingport LWBR reactor core at the end of its life.

Strategy and Scope

The IFAG will be used by BAPL to nondestructively assay a large sample of the fuel rods that will be discharged at the end of life (EOL) of the Shippingport LWBR core. The results of this assay will indicate the extent of fuel breeding accomplished.

COMMITTEE ACTION

Water Cooled Breeder—$19.8 million decrease

It has been shown that the Water Cooled Breeder offers no clear non-proliferation advantage over other fuel cycles. In addition, there is a lack of utility/industry involvement in the program and there is no focus on commercialization of the water-cooled breeder concepts. As a result, the Committee reduced funding for FY 1981. The Advanced Water Breeder Applications (AWBA) program was reduced by $14.8 million. This will result in reduced efforts in developing methods for producing the U-233 needed for breeder reactors; improved breeding, engineering component development and testing, and the conceptual design of commercial size prebreeder and breeder reactors.

The Light Water Breeder Reactor (LWBR) program was reduced by $5.0 million. This program encompasses development of the technologies required for the successful design, fabrication, operation, testing and examination of a breeder reactor. The Committee's action will reduce efforts in the preparation for removal, shipment, and examination of the expended LWBR core, research into the nuclear and materials characteristics of the thorium/uranium 233 fuel system in light water reactors and analytical and experimental development supporting performance capability of zircaloy-clad thorium based oxide fuel.

(c) Gas Cooled Breeder Reactor

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses	19,988	0			0
Capital equipment	1,500	0			0
Construction	4,512	0			0
Total	26,000	0			0

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

Like the Liquid Metal Cooled Fast Breeder Reactor, the Gas Cooled Fast Breeder Reactor (GCFR) has the potential for extending the uranium resource base to a practically inexhaustible source of electrical energy; however, it is at a significantly lesser stage of development. Because of the importance of having a viable breeder reactor to sustain the long-range nuclear power option for the Nation, the GCFR was in the Nation's fission energy program backup to the mainline LMFBR program should that effort not satisfactorily meet its objectives. In addition, it offered utilities a second choice for a breeder plant in a competitive market place.

The GCFR has a number of characteristics which made it a suitable alternative breeder. However, all of these potential advantages are based on a relatively immature technological data base. It has the combined potential of a relatively high breeding ratio, flexibility to operate on virtually any combinations of fissile and fertile fuels, relatively low development costs (if conducted simultaneously with related LMFBR and HTR technology programs), and some possibility for lower capital and maintenance costs.

Current Status

Because of the current status of the U.S. and worldwide LMFBR technology, the Administration believes there is no longer a need for a backup breeder to the LMFBR. If there were insurmountable technical problems with the LMFBR these problems would have been evident by now as the result of extensive actual reactor operating experience over the past 30 years. Furthermore, the recently completed NASAP studies have not shown any advantage of the GCFR over the LMFBR as a nonproliferation breeder concept and these studies estimated the total RD&D costs to be several billions of dollars. Consequently, DOE support of GCFR has not been included in the Presidential budget for FY 1981, and it is proposed to bring the program to an orderly conclusion starting in FY 1980.

COMMITTEE ACTION

Gas Cooled Breeder Reactor—No change

(d) FUEL CYCLE RESEARCH AND DEVELOPMENT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses	18,600	9,000		+9,000	18,000
Capital equipment	2,500	400		+3,000	3,400
Construction	6,400	0		0	0
Total	27,500	9,400		+12,000	21,400

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

Background.—Nuclear fuel reprocessing was a necessary part of weapons-material production during World War II. The basic technology for the Purex process evolved from those early wartime plants as weapons-material production capability expanded in the early 1950s. That same Purex process is the basis of the process adopted for reprocessing commercial fuel from nuclear power plants.

Several attempts to commercialize Purex solvent extraction reprocessing in the U.S. have failed to engender a thriving commercial industry:

> The Nuclear Fuel Services (NFS) Plant in West Valley, N.Y., operated for about five years before its shutdown in 1972. The total fuel reprocessed there was about half the plant's nominal capacity, and most of that was low-exposure fuel from the government-owned N Reactor. The owners of the NFS plant have abandoned all plans for restart.
>
> The General Electric Co. reprocessing plant at Morris, Ill., was never started due to major engineering deficiencies identified during coldtesting of the plant.
>
> The Allied General Nuclear Services (AGNS) Plant at Barnwell, S.C., is essentially complete for reprocessing but stands idle pending further government decisions on reprocessing. However, if a positive decision were made to proceed with reprocessing, major segments would have to be added for waste solidification and plutonium conversion.

The major technical uncertainties that hindered these attempts to commercialize reprocessing, and fostered the growth of the Fuel Cycle R&D program, do not relate to Purex flowsheet development, but rather to the engineering of the major equipment items required for reprocessing commercial fuel. The Fuel Cycle R&D program was initiated in FY 1976 to address such technical uncertainties that precluded the commercialization of spent-fuel reprocessing. The elements of the program drew from then existing programs for HTGR and

LMFBR fuel recycle, which until that time had been funded as part of those reactor development programs. A new element was added to address LWR fuel recycle exclusively.

On April 7, 1977, President Carter announced a new nuclear energy policy, which deferred idefinitely the reprocessing of commercial spent fuel so as to allow time to investigate more proliferation-resistant alternative fuel cycles. As the result of the new policy, the program was reoriented to investigate optional technologies involving a variety of combinations of fissile and fertile materials (uranium, plutonium, and thorium). The recovery and reuse of fissile values from these fuels for various reactor configurations with minimum proliferation risk would involve the modification of familiar separations technologies (i.e. Purex) and/or the introduction of new technologies (i.e., pyrochemical and dry methods).

Budget reductions in FY 1979 caused the Fuel Cycle R&D program elements to be consolidated into a generic functional alignment so as to optimize the use of resources and to effect a more consistent method for setting program priorities. The program also includes analytical activities to support the demonstration of proof of breeding (POB) for the Light Water Breeder Reactor (LWBR).

In FY 1981 the Administration proposed that the consolidated management approach be oriented to support fuel-cycle concepts deemed consistent with U.S. nonproliferation objectives. Within the Administration's context, only breeder reactors appear to require reprocessing at this time. Thus, if fuel reprocessing is to be undertaken, it will be conditioned on eventual deployment of a breeder. For this reason the Administration proposed that the reprocessing activities within the Fuel Cycle R&D program be focused on developing breeder fuel reprocessing technology.

Objectives

The objective of the Fuel Cycle R&D program to develop and demonstrate proliferation-resistant fuel cycles that enable nuclear energy to contribute to meeting the nation's energy needs while effectively using natural resources and protecting the environment.

Strategy and Scope

To meet the objectives of the reprocessing program, emphasis is placed on developing and demonstrating the reprocessing of spent fuel from Breeder reactors. A variety of scenarios are considered, involving breeder reactors inside secured centers operating in conjunction with converter reactors outside secured centers on both uranium and thorium-based fuel cycles. Therefore, the program is flexible so that it can respond to the implementation of any of a number of reactor-fuel cycle systems depending on NASAP and INFCE results and future breeder decisions. Fuel-cycle development activities will be conducted on an appropriate engineering scale such that uncertainties relating to the transition from laboratory to practice can be adequately addressed. Ultimate testing of the reprocessing processes and equipment under actual operating conditions using irradiated fuels discharged from test and demonstration reactors will be required to establish suitability for practical application and to demonstrate the adequacy of applied proliferation-resistance measures; a Hot Experimental Facility (HEF) is planned for this. This program is closely coupled with the activities under Light Water Reactor Fuel Cycle R&D.

Reprocessing

Fast reactor fuels of U.S. designs are generically similar to light-water-reactor fuels and can be reprocessed using the same base technology—i.e., the shear-leach head-end followed by solvent extraction. There are, however, significant differences in such things as fuel cladding, fuel-geometry, fissile content, decay heat, and radiation levels, which create special problems in applying directly the existing technology base. Although solutions to the technology needs that are unique to reprocessing fast reactor fuels will be obtained by building from the existing LWR technology base, there are many instances where new equipment concepts and additional process steps must be developed.

One breeder option being considered uses a plutonium fueled core, so the base technology being developed for core fuel recycle is being continued. In addition, several activities will be initiated to integrate thorium-based fuel concepts into the current technology.

Objectives

The objectives of this program is to:

Provide a sound reprocessing technical-data base for making decision on deployment of breeder reactor systems, and

Facilitate the establishment of actual recycling capability when deployment is called for.

An additional goal is to evaluate the feasibility of using alternative methods of reprocessing breeder fuels that minimize the risk of diversion of weapons-usable fuel material.

Strategy and Scope

To accomplish the primary goals, the development effort associated with each breeder fuel recycle mission is being carried through appropriate stages to produce a fully engineered reprocessing system.

COMMITTEE ACTION

LMFBR Fuel Cycle—$12 million increase

The Administration's proposed budget essentially closes out all fuel cycle R. & D., with no funds projected for future years except for the Water Cooled Breeder. Increased funding will permit R. & D. on engineering problems associated with reprocessing fuel and developing proliferation resistant fuel cycles.

The Committee added funds to the LMFBR fuel cycle R. & D. program to provide support to the equipment development activity—the focus of which is the Integrated Equipment Test (IET) Facility at Oak Ridge, Tennessee. The IET is fully funded in FY 1980; however, the FY 1981 Department of Energy submission did not provide funds for its operation or completion of major developmental equipment to be tested in the facility. This increase will allow for testing and limited operation of the remote operation and maintenance demonstration (ROMD) section of the IET, limited system check-out of the integrated process demonstration (IPD) section, and early installation of the dissolver, shear and voloxidizer. This mark will also provide for continued use of the Solvent Extraction Test Facility (SETF) at Oak Ridge for evaluating different coprocessing flow sheet arrangements on a continuous basis at full activity levels.

6. URANIUM RESOURCE ASSESSMENT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses: Uranium resource assessment	7,000	4,000	--------------	12,000	6,000
Total:	7,000	4,000	--------------	+2,000	6,000

[1] Indicates changes to original fiscal year 1981 B/A request.

The goals of the Uranium Resource Assessment program are to assess the nuclear fuel resources of the United States; reduce uncertainties about the estimated extent, availability and economics of domestic and foreign nuclear fuel resources; and make available to industry technology and resource information for use in the development and production of uranium resources.

The FY 1980 program was based on the determination that the information base on uranium resources must be improved and increased substantially by the end of FY 1980 for critical nuclear energy policy decisions. For FY 1981 the administration has proposed that the program be stretched out because of a projected reduction in the growth of nuclear power.

Objectives

The primary objectives are to: (1) continue assessment of U.S. uranium resources, economics and availability (2) publish by the end of fiscal year 1983 a report on the assessment of potential uranium resources of approximately 200 priority quadrangles, investigations of 6 World-Class sites and 5 intermediate grade resource sites; (3) publish by the end of fiscal year 1985 a report on the assessment of approximately 300 quadrangles, (4) publish by the late 1980's a comprehensive assessment of the uranium resources of the coterminous United States and Alaska.

Strategy and scope

The proposed budget for geologic and related investigations will provide a reduced level of effort and a later completion date for the systematic and comprehensive assessment of U.S. resources. Quadrangle evaluation, assessment and folio preparation activities will be stretched out, and most of the activity will be undertaken by the DOE principal contractor. The national airborne reconnaissance survey will continue at a level that will allow completion of the flying phase for the coterminous United States and Alaska in FY 1981 and open-filing of reports in FY 1982. This program will provide data for quadrangle assessment and provide a basis for developing priorities for subsequent quadrangle evaluations. Highest priority will be given to quadrangles expected to provide the largest change in United States resource estimates.

The national hydrogeochemical and stream sediment survey will be completed for those quadrangles which have been sampled or for which sampling contracts are currently in effect. Sample assaying and reporting for these quadrangles will be essentially completed in FY 1981. Additional geochemical sampling will be conducted only in specific areas identified through aerial surveys and other available information. This reduced level of effort for the geochemical survey will require reduction in the number of labs from the current level of three to only one. These funds will provide for close-out of two labs in FY 1981.

As a result of programmatic activities completed to date, about 840,000 of the planned 1,100,000 reconnaissance flight line miles to be covered by the aerial radiometric survey will have been completed by the end of FY 1981. Over 160,000 feet of drilling to assess favorability of uranium will have been completed with some intersections of mineralized ground. These activities as well as other geologic investigations will lead to the assessment of 150 priority quadrangles by the end of FY 1981.

COMMITTEE ACTION

Uranium Resource Assessment—$2 million increase

While this program is primarily directed at commercial resource assessment, the Committee has identified $4 million in funding which covers the R&D element of the program and transferred these funds from Title VII to Title I of the bill.

In addition, the Committee increased funding by $2 million to provide for a better characterization (on the basis of the available information on resources) of a prudent planning base of resources for making critical nuclear energy policy decisions.

The Administration has proposed a large cut in the Uranium Resource Assessment program which would provide a later completion date for the systematic and comprehensive assessment of U.S. resources (a 5-year delay). The Administration is also basing the phaseout of the breeder programs on an adequate uranium supply through 2020.

The increased funding will expand the present program to determine the actual availability of uranium as an overall resource estimate and yearly production capability, considering the confidence levels of the resource estimates, their discoverability and producibility, market conditions and restrictions such as potential land withdrawals, environmental impacts, licensing and regulation. Only with this program will we have a meaningful, prudent R&D planning base for uranium resources. The Committee specified that the results of this assessment be reported to the Congress by the end of FY 1981.

In addition, the Committee amended the bill to direct that the Secretary transmit to the President and the Congress a report on the long-term policy and plan for U.S. uranium enrichment as soon as practicable, but not later than the date of submission to the Congress of the DOE FY 1982 budget.

The report will provide a full and complete statement of the Department's policy governing commercial uranium enrichment services and an associated plan, with appropriate projections, to the year 2000.

7. URANIUM ENRICHMENT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request [1]	Committee Action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Uranium enrichment activities	777, 969	905, 226	−43, 000	−43, 000	862, 226
Advanced isotope separation	46, 200	66, 355	−3, 000	+6, 000	72, 355
Subtotal, operating expenses	824, 169	971, 581	−46, 000	−37, 000	934, 581
Program direction	3, 044	4, 004			4, 004
Subtotal	827, 213	975, 585	−46, 000	−37, 000	938, 585
Capital equipment:					
Uranium enrichment activities	23, 430	27, 300			27, 300
Advanced isotope separation	8, 000	9, 000			9, 000
Subtotal, capital equipment	31, 430	36, 300			36, 300
Construction:					
Authorization		515, 795		−342, 000	173, 795
Budget authority	449, 975	451, 645	−190, 000	−193, 700	257, 945
Total:					
Authorization		1, 527, 680		−379, 000	1, 148, 680
Budget authority	1, 308, 618	1, 463, 530	[2] [−236, 000] −184, 485	[2] [−230, 700] −179, 185	1, 284, 345

[1] Indicates changes to original fiscal year 1981 budget authority request.

[2] −$179,185,000 is actual reduction resulting from the −$230,700,000, due to return to Treasury of excess revenues.

(a) URANIUM ENRICHMENT ACTIVITIES

URANIUM ENRICHMENT ACTIVITIES

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Change to original authorization request	Total authorization (budget/authority)
Operating expenses:					
Gaseous diffusion operations and support	712, 369	840, 426	−43, 000	−43, 000	797, 426
Gas centrifuge operations and support	65, 600	64, 800			64, 800
Subtotal, operating expenses	777, 969	905, 226	−43, 000	−43, 000	862, 226
Program direction	2, 326	3, 060			3, 060
Subtotal	780, 295	908, 286	−43, 000	−43, 000	865, 286
Capital equipment:					
Gaseous diffusion operations and support	19, 400	24, 000			24, 000
Gas centrifuge operations and support	4, 030	3, 300			3, 300
Subtotal, capital equipment	23, 430	27, 300			27, 300

URANIUM ENRICHMENT ACTIVITIES—Continued

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Change to original authorization request	Total authorization (budget/authority)
Construction:					
Authorization		467, 125		−300, 600	166, 525
Budget authority	449, 175	441, 000	−190, 000	−190, 000	251, 000
Total:					
Authorization		1, 402, 711		−343, 600	1, 059, 111
Budget authority	1, 252, 900	1, 376, 586	[−233, 000] [2] −181, 485	[−233, 000] [2] −181, 485	1, 195, 101
Application of unobligated balances and revenues—budget authority	−1, 310, 000	−1, 289, 045			−1, 289, 045
Total:					
Authorization		1, 402, 711		−343, 600	1, 059, 111
Budget authority	57, 100	87, 541	[−233, 000] [2] −181, 485	[−233, 000] [2] −181, 485	−93, 944

[1] Indicates changes to original fiscal year 1981 budget authority request.

[2] $181,485,000 is actual reduction resulting from the −$233,000,000, due to return to Treasury of excess revenues.

The goal of the uranium enrichment activities program is to meet domestic, foreign and United States Government requirements for uranium enrichment services in the most economical, reliable, safe and environmentally acceptable manner possible.

The DOE presently enriches uranium to the desired U–235 product assay levels in its gaseous diffusion plants located at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky. These plants were built in the 1940's and 1950's and were operated initially to satisfy defense requirements for U–235. They are now used primarily to provide enrichment services to domestic and foreign nuclear power reactor customers. In these plants, DOE enriches the customers' natural uranium in the U–235 component for a fee. The charges for the enrichment services are based on recovery of the Government's costs over a reasonable period of time, in accordance with Section 161V of the Atomic Energy Act of 1954, as amended, and with the Uranium Enrichment Services Criteria. The costs of providing enrichment services include the electric power supplied to the enrichment plants, the direct and indirect labor needed to operate the plants, process development, DOE administration, the depreciation on plant and equipment, and imputed interest on plant, equipment and inventories.

The DOE has underway an extensive capacity expansion effort using the gas centrifuge process which will dramatically reduce power demand for enriching uranium. This effort will lead to the construction of centrifuge enrichment facilities at Portsmouth, Ohio. The initial production from this plan will begin in 1987, with a capacity of 2.2 million separative work units (SWU) in operation by 1988. This plant can be completed by adding enrichment capacity in blocks of 1.1 million SWU sequentially as dictated by enrichment demand up to a total of 8.8 million SWU.

In fiscal year 1981, the DOE enrichment program is planned to continue meeting the program objectives in a manner that recognizes the near-term reduced demand for nuclear power, and a longer term increasing demand consistent with projections by the utilities and

DOE national electric power estimates. The latter has been considered in the continuation of the Cascade Improvement Program/Cascade Uprating Program which will improve gaseous diffusion efficiency and will be completed on schedule at the Oak Ridge, Tennessee, and Paducah, Kentucky, sites in 1981. Completion of the program at the Portsmouth, Ohio, site is currently planned for 1982 or 1983 reflecting delays in the program resulting from a recent strike at that site.

The DOE enrichment operating plan reflects lower near-term electric power requirements consistent with reducing enriched uranium inventory build-up while still meeting demand. Accordingly, DOE will operate the gaseous diffusion complex at its minimum purchased power level of 2,660 MW in FY 1981.

The operating and transaction tails assays at the enrichment plants are currently set at 0.20 percent U–235, a level that conserves natural uranium. It is planned that these tails assays will be maintained until at least the late 1980's.

The marketing effort is continuing to induce customers to select the U.S. as an enrichment supplier, rather than the several alternative foreign suppliers that are now actively competing for enrichment services orders. U.S. enrichment contracts require customers' adherence to criteria designed to meet non-proliferation goals. Marketing efforts stress the U.S. advantages of price and reliability of supply including the commitment to the new gas centrifuge plant and the U.S. willingness to recognize and consider customer problems and desires in as close to a commercial relationship as possible.

In fiscal year 1979, approximately 13.9 million SWU's were produced. In fiscal year 1980, about 10.6 million SWU's are projected to be produced. The enriched uranium product contains the energy equivalent of about 1.2 and 0.9 billion barrels of oil respectively.

Specific planned accomplishments resulting from the budget as proposed will include the following: (1) production of 9.5 million separative work units (the enriched uranium product contains the energy equivalent of about 0.8 billion barrels of oil); (2) continuation of capital equipment and construction support for meeting production targets; (3) continuation of health, safety, and environmental improvements to assure that the plants will meet state and Federal standards; (4) maintenance of the approved construction schedule for the gas centrifuge enrichment plant and the cascade improvement and uprating programs; (5) continuation of gaseous diffusion development and technical support necessary to maintain high onstream efficiency and; (6) continuation of centrifuge development in support of the gas centrifuge enrichment plant. This program will satisfy domestic and foreign requirements for enrichment services. In addition, the Government will recover its full cost of providing enrichment services, and the program will continue to make a significant contribution to the U.S. balance of payments.

(1) Gaseous Diffusion Operations and Support

This activity includes the operation of the gaseous diffusion plants at Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky where uranium enriched in the uranium 235 isotope is produced by toll enriching uranium delivered by customers and by enriching uranium for government requirements. The proposed budget includes funds for all of the operating and support requirements for the continued operations of the three diffusion plants and to assure that these plants are maintained. Funds are also included for the purchase of cascade power, cascade operations, process and long term technical support, and supporting services requirements. In addition funds are included for necessary capital equipment to support the operational requirements of the plants.

The following line item construction projects are included in the FY81 proposed DOE budget: (1) general plant projects; (2) UF_6 cylinders and storage yards; (3) utilities upgrading; (4) supervisory control and data acquisition systems; (5) instrumentation for purge cascades and withdrawal areas; (6) environmental protection, and safety improvements Phase I; (7) motor and switchgear upgrading; (8) power recovery demonstration cells; (9) plant facilities security improvements; (10) control of water pollution; (11) control of gaseous effluents; and (12) process equipment modifications.

Operation of the gaseous diffusion plants requires large amounts of electric power to pump the process gas (UF_6) through the separation stages to achieve the required enrichment. Cascade power is the portion of purchased power which is used to operate the gaseous diffusion equipment and auxiliaries. Electric power is obtained under long term contracts from the following suppliers: Tennessee Valley Authority (TVA)—Oak Ridge and Paducah; Electric Energy Incorporated (EEI)—Paducah; and Ohio Valley Electric Corporation (OVEC)—Portsmouth.

The current contract requirements for power in FY 1980 are currently estimated at $603,000,000 versus an appropriation level of $548,336,000. Subsequent to the submission of the FY 1980 budget, 1) TVA raised power rates above those provided for in the budget and 2) DOE received indications that TVA will not take all of their seasonal power reductions and consequently power deliveries will likely be higher than projected in the budget. This new estimate is based upon the firm power deliveries as called for in our power contracts.

Based on the latest information available with regard to nuclear power growth and the timing of power plant construction and completion, the current projection is that requirements for enrichment services are slipping in the near-term from previous estimates. Accordingly, DOE will operate the gaseous diffusion complex at its minimum purchase power level of 2,660 MW in FY 1981. This action will result in the purchase of less power from TVA and OVEC than required in the current contracts with these two power suppliers. This will require DOE to pay demand charges for power not purchased totaling $43,000,000 (TVA—$23,000,000; OVEC—$20,000,000). The $43,000,000 has been included in the proposed budget. DOE will undertake negotiations with the three power suppliers in an effort to reduce or eliminate the demand charge payments that are required by the FY 1981 budget.

(2) Gas Centrifuge Process Development and Demonstration

The goals of the gas centrifuge development and demonstration program are to demonstrate the gas centrifuge technology required for installation in the Portsmouth Gas Centrifuge Enrichment Plant (GCEP), to improve the efficiency of this technology for incorporation in the long-term operation of the GCEP, and to establish a competitive and viable manufacturing industry for the process equipment and centrifuges used in a centrifuge enrichment plant.

The requested funding represents a continuation of current program tasks, operation of existing facilities, and support for construction projects designed to provide capability for testing and qualification of the GCEP centrifuge, plus investigation of the potential for improved centrifuge performance. The primary thrust of the development program through FY 1981 is to provide qualified designs for the centrifuge and supporting components to be used in GCEP. With the startup of the Centrifuge Plant Demonstration Facility (CPDF) in 1982, the centrifuge development program emphasis is expected to shift to improving the centrifuge performance for the later GCEP increments.

The centrifuge program will continue to place more responsibility upon industry for the supply of components and hardware necessary to continue the demonstration of the centrifuge technology.

Centrifuge physics investigations have developed a technology base necessary for long term operation of centrifuges. However, a comprehensive theory to guide future improvements and to identify areas for further exploration to optimize centrifuge performance has not been completed. Investigations will be conducted on the most promising cascade designs, on improved efficiency of operation through an optimization of gas flow, and on creating and modifying computer models to simulate operating phenomena within the centrifuge.

Materials currently used in centrifuge manufacturing are well characterized and of adequate supply for immediate requirements. However, industrial capacity for manufacture of these materials for Gas Centrifuge Enrichment Plant scale requirements does not exist. Alternate material investigations are being conducted.

Data from centrifuge physics and materials development will be utilized in analysis of the first complement of Gas Centrifuge Enrichment Plant model centrifuges to optimize performance.

Demonstration testing on the supporting systems will be conducted as part of a fully developed system for installation in the Gas Centrifuge Enrichment Plant. Procedures will be generated for the manufacture of materials with corrosion-resistant properties operating in the UF_6 environment. Testing of prototypes and evaluation of Gas Centrifuge Enrichment Plant application will continue. Vendor qualification on gas handling items will continue and continue to be integrated into other Gas Centrifuge Enrichment Plant activities.

Vital data obtained from the operation of test facilities will be collected and evaluated for input to the continuing Gas Centrifuge Enrichment Plant construction. The major test facilities whose operation will continue through 1981 include (1) the Advanced Equipment Test Facility for reliability testing of the Gas Centrifuge Enrichment Plant model centrifuges; (2) the Component Preparation Laboratories for development of manufacturing processes, assembly operations and screening tests of centrifuges produced; (3) the Component Test Facility for testing of large centrifuges cascades and for support of the materials program, the largest facility for centrifuge operation in the program; (4) the Equipment Test Facility for reliability testing of earlier centrifuge models and for support of the materials program; and (5) the Advanced Machine Development Laboratory for characterization of prototype centrifuges and for mapping of sample machines to establish limits on operating parameters. Additionally, substantial support is also required for the Centrifuge Plant Demonstration Facility, which is scheduled for start-up in 1982.

COMMITTEE ACTION

Uranium Enrichment—$343.6 Million Decrease

Operating expenses for Gaseous Diffusion Operations and Support were reduced by $43 million. By this action, the Committee eliminated funds for power demand charges of both the Tennessee Valley Authority (TVA) and Ohio Valley Electric Company (OVEC). This cut was also included in the Administration's amended budget request. The DOE contracts with TVA and OVEC should be renegotiated in light of this budget cut.

The Committee reduced the authorized level of funding for Project 71–1–f, Process Equipment Modifications, Gaseous Diffusion Plants, by $111,600,000 in order to reduce the Fiscal Year 1981 budget authority by $20,000,000. This was a budget-cutting measure but was believed to be consistent with the schedule slippage at Portsmouth which resulted from a labor strike.

The project is expected to require additional authorization in Fiscal Year 1982.

Project 76–8–g, Enriched Uranium Production Facilities, Portsmouth, Ohio was authorized at $116,325,000 instead of the $286,325,000 originally requested by the Department. This action was taken to support the Administration's amended budget request which was to delay the project one year by reducing the budget authority $170,000,000. The Committee recognizes that this position is not necessarily the best approach to long-term energy conservation, proper economic policy, effective foreign relations, or acceptable construction management practice. This was done, instead, to satisfy overall budgetary constraints for Fiscal Year 1981.

The Committee recognizes that this delay will cost more money in the long run. For example, one analysis indicates that $200,000,000 in 1980 dollars will be lost by introducing the one-year delay in project completion. This delay will result in the extended and inefficient use of professional labor and increased project duration. In addition, the delay will result in about a $500 million increase in operating costs because of the need to operate an equivalent capacity of the relatively inefficient gaseous diffusion units for an extra year. This increased cost will be experienced over several years beginning in 1988 when the first train of GCEP was scheduled to come on line until the last unit is operational, now scheduled for late 1994. This cost increase assumes that the demand for enrichment services will be such that, as GCEP units become operational, equivalent diffusion capacity will be cut back and the savings in reduced electric power used is based on the current costs of power. Finally, inflation will also add substantially to these estimated increased costs.

The Committee has accepted these cost increases and delay with reluctance and notes that any further delay in the future beyond this one year now projected would be unacceptable.

The Committee reduced authorization for Project 81-R-506, Environmental Protection and Safety Modifications, Phase I, Gaseous Diffusion Plants, by $19 million. There is no change in budget authority. This reduction in authorization will not delay project completion. The total project cost is estimated at $500 million to $800 million. The scope of work includes significant equipment additions to the gaseous diffusion plants, further upgrading environmental protection features.

In addition, the Committee amended the bill to direct that the Secretary transmit to the President and the Congress a report on the long-term policy and plan for U.S. uranium enrichment as soon as practicable, but not later than the date of submission to the Congress of the DOE FY 1982 budget.

The report will provide a full and complete statement of the Department's policy governing commercial uranium enrichment services and an associated plan, with appropriate projections, to the year 2000.

(b) ADVANCED ISOTOPE SEPARATION

[In thousands of dollars[

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Applications and assessments of advanced technologies	5, 000	9, 000	−3, 000	−3, 000	6, 000
Uranium enrichment activities	41, 200	57, 355		+9, 000	66, 355
Subtotal, operating expenses	46, 200	66, 355		+6, 000	72, 355
Program direction	718	944			944
Subtotal	46, 918	67, 299		+6, 000	73, 299
Capital equipment: Facility operations	8, 000	9, 000		0	9, 000
Construction:					
Authorization		48, 670		−41, 400	7, 270
Budget authority	800	10, 645		−3, 700	6, 945
Total authorization		124, 969		−35, 400	98, 569
Total budget authority	55, 718	86, 944		+2, 300	89, 244

[1] Indicates changes to original fiscal year 1981 B/A request.

Objective

The strategic objective of the Advanced Isotope Separation (AIS) Program is to conserve uranium resources by developing and demonstrating a uranium enrichment technology which will permit the economic lowering of the tails assay from the U.S. enrichment complex while providing slightly enriched uranium for LWR's at costs less than half of currently used technology. The current enrichment technologies can economically recover only about 70 percent of the uranium-235 from the naturally occurring isotopic mixture. The technologies being developed as part of the AIS program would permit the recovery of about 90 percent of the fissile isotope. Thus, 20 percent additional reactors could be fueled from any fixed quantity of ore if an AIS technology were employed for enrichment.

Other objectives of the Advanced Isotope Separation Technology activity are to:

1. Evaluate new enrichment technologies to assess their proliferation potential, and
2. Pursue the application of the AIS technologies to other energy related problems.

Strategy and Scope

The AIS program is pursuing three different technologies: two laser processes, and one plasma process. The scientific feasibility of all three processes has been demonstrated and excellent progress continues to be made in the program. No fundamental barriers have been identified which would preclude any of the technologies from achieving the program's goal. The funds requested for FY 1981 will permit the completion of the construction of large testbed systems, begun in FY 1979, which is the first step toward engineering demonstration. The semi-integrated test beds will verify the scientific principles of the AIS technologies with scaled-up components. A decision is scheduled to be made the end of FY 1982 as to which of the three processes should proceed to engineering development, the next phase of the AIS program. The engineering development phase will lead to the operation of a Development Module in the mid-1980's which will demonstrate a completely integrated process, using one half to full-scale production sized equipment, with sufficient reliability to develop a firm basis for determining production costs.

The construction line items included in the FY 1981 budget are essential if the program is to demonstrate economic viability of a process in the mid-1980's. The facilities will provide the general purpose laboratory space required to support the development and testing of the laser systems and process components which will be required for the engineering phase of the program. The inclusion of a new industrial partner into the DOE activity in FY–81 will provide an important resource to the program.

Atomic Vapor Process

The atomic vapor process takes advantage of the small differences in the electronic spectra of uranium isotopes. The process requires the controlled vaporization of uranium atoms followed by selective excitation and ionization of uranium-235 using tunable lasers in the visible or ultraviolet regions of the spectrum. The resulting plasma of uranium-235 ions can then be removed from the uranium vapor using electromagnetic methods. The large-scale generation of vapor under required process conditions, the handling of molten uranium, the demonstration of a scalable uranium ion extractor, and the development of full-scale lasers suitable for plant operation are under intensive investigation.

The major areas of required development effort for the atomic process are:

Laser Development:

Increase the average power output per laser.

Increase the number of times the laser flashes per minute (improved repetition rate).

Material Development:

Improve the lifetime of material exposed to liquid uranium and uranium vapor.

Extractor Development:

Develop an ion extractor technique to operate at the densities required for a production module.

An important component of the process development program is the uranium vapor generation source. The design and fabrication of the uranium handling system for the preprototype testbed began in FY 1979. Toward the end of FY 1980, the uranium handling systems will be installed. The total system, including lasers and electro-optical components, will become operational toward the end of FY 1981.

Molecular Process

In the molecular process, UF_6 is expanded through a nozzle to reduce the temperature and simplify the spectrum of the gas. The UF_6 is then exposed to laser radiation in the infrared and ultraviolet, yielding enriched uranium as solid UF_5, which can be separated from the gaseous UF_6. This process has intrinsically high throughputs and uses existing materials—handling technologies. However, the high power lasers at the specific wavelengths required are not yet available, although considerable progress has been made.

The major areas of development required for the molecular process are:

Laser Development:

Increase the average power output per laser at the requisite wavelengths.

Increase the number of times a laser flashes per minute (improved repetition rate).

Science:

Increase the basic understanding of the interaction between the laser and the process gas.

Some questions still exist on details of the molecular process involving the interaction of the laser energy and the gas. During FY 1980, experiments are planned to define these phenomena better.

High power lasers for the preprototype system, which were ordered from industrial vendors, are expected to be delivered during FY 1980 and installed on the molecular process preprototype testbed which will become fully operational towards the end of FY 1981.

Plasma Process

The plasma process is based on ion cyclotron resonance. The method involves generating a stable plasma in a magnetic field thereby establishing different ion cyclotron frequencies for the individual isotopes. The frequency of an RF field is then tuned to the ion cyclotron frequency of the U-235 where resonance is achieved and energy absorbed by the U-235 ion. This results in an increase of the cyclotron orbit and energy of this species. These differences are used to separate the non-resonant U+ from the resonant enriched U+.

The major areas of development required for the plasma process are:

Plasma Source:

Increase the routine operation of scalable plasma sources.

Material Handling:

Increase the lifetime of material exposed to uranium.

Science:

Increase the scientific knowledge of the plasma process and establish scaling laws.

Some science questions on the plasma process are still unrevolved. Prior to FY 1979 small magnet systems were used as research testbeds. During FY 1979, a larger magnet system began operation to aid in the determination of the process parameters and scaling laws.

The preprototype magnet system is now in fabrication with delivery expected in early FY 1981, and operation scheduled towards the end of FY 1981.

Supporting Technology

This area of effort is conducted at the Oak Ridge Gaseous Diffusion Plant and is composed primarily of scoping conceptual engineering and cost analyses for the three separation technologies. For this study, detailed cost models for all three processes were developed. In general, as more information is obtained for the three processes, the cost models are updated and sensitivity analyses performed on selected variables. These analyses highlight the relative importance of the parameters and serve to direct the R&D programs by identifying the variables that have high leverage in the process costs.

The major activities for FY 1981 are to obtain better definitions of the costs of key systems requiring industrial expertise; examples are laser systems, electro-optical systems and large superconducting magnets.

Plant and equipment layouts will be updated to reflect the current reference design and to establish equipment and building costs that are more accurate.

The computer models describing the process science will be updated to provide a more accurate analysis based on process experiments and updated theory.

Application and Assessments of Advanced Technology

Advances in science and technology have opened new vistas for economical isotope separation using processes previously thought to be impractical, if not impossible. In addition, the development of laser isotope separations technology affords a new and powerful technique that can be applied to the solution of problems in other energy areas. Research and development on these new concepts are designed to ensure that the U.S. maintains its leadership in isotope enrichment methods and exploits the use of these technologies to the solution of energy-related problems.

The objectives of the applications and assessments of advanced separations technologies are to:

Maintain DOE on the forefront of understanding uranium separation methods, evaluate new uranium enrichment technologies, and accurately assess their proliferation.

Apply advanced separation technologies to energy-related problems.

Experiments are being performed to evaluate the uranium chemical exchange separation process, including the French technique, and to develop the scaling laws required to analyze the proliferation implications of these technologies.

COMMITTEE ACTION

Advanced Isotope Separation Technology—$35.4 million decrease

A $3 million decrease in authorization for assessing foreign technologies was approved by the Committee. This will merely slow the pace of this newly instituted program and is consistent with the Administration's revised budget recommendations.

Nine million dollars in operating expenses and $1 million for construction of the Laser Isotope Separation Facility (78-5-c) was added to provide the Exxon Nuclear-Avco Everett partnership a viable role in the FY 1981 Department of Energy Advanced Isotope Separation Technology (AIST) program. The construction funding is only for Title I and II design of the next demonstration module phase. The operating funding will allow Exxon to compete on an equal footing with the present DOE program.

The Committee also approved a reduction of $27.9 million in authorization and $4.7 million in budget authority for construction of the Isotopes Research and Development Laboratory (81-T-502) at Lawrence Livermore Laboratory. This will delay actual construction until FY 1982 and places Lawrence Livermore Laboratory on a comparable footing with a similar construction project at Los Alamos Scientific Laboratory.

A reduction of $14.5 million in authorization only (no change in budget authority) for construction of the Isotopes Research and Development Laboratory at Los Alamos, New Mexico (81-T-501) was approved. This reflects the Committee's policy that no construction proceed past the design stage until DOE decides on what basis the three competing processes will be compared, and establishes "equivalent scientific milestones" which the participating research organizations can aim toward.

B. Fusion Energy

1. MAGNETIC FUSION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Applied plasma physics	49, 700	65, 800		0	65, 800
Confinement systems	90, 090	105, 100	−3, 800	−4, 500	100, 600
Development and technology	48, 000	63, 600	−1, 000	+7, 000	70, 600
Planning and projects	42, 410	48, 500		+9, 500	58, 000
Subtotal, operating expenses	230, 200	283, 000		+12, 000	295, 000
Program direction	2, 905	3, 117		+183	3, 300
Subtotal	233, 105	286, 117		+12, 183	298, 300
Capital equipment	29, 800	38, 100	−200	+5, 000	43, 100
Construction:					
Authorization		171, 840		+25, 860	197, 700
Budget authority	92, 500	79, 400	−2, 500	+13, 700	93, 100
Total authorization		496, 057		+43, 043	539, 100
Total budget authority	355, 405	403, 617	−7, 500	+30, 883	434, 500

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

The budget for the Office of Fusion Energy's program in magnetic fusion is organized into four activities: Confinement Systems, Development and Technology, Applied Plasma Physics, and Reactor Projects. The function of each budget activity is as follows:

Confinement Systems—To conduct experimental activities aimed at demonstrating and refining methods of heating and containing high-temperature plasmas in tokamak, magnetic mirror, and bumpy torus systems.

Development and Technology—To provide for development of engineering and technological bases to design, construct, and operate increasingly larger and more complex fusion experiments and facilities, and perform conceptual design work for the Fusion Engineering Test Facility.

Applied Plasma Physics—To pursue experimental and theoretical studies of fusion plasma phenomena needed to develop the knowledge required to predict thermo-nuclear plasma behavior in confinement systems, and future fusion power systems; to pursue new confinement concepts which may be alternatives to the tokamak and magnetic mirror approaches.

Planning and Projects—To provide for the construction of, and project specific development for major new facilities needed by the other activity and subactivity areas.

SIGNIFICANT ISSUES

The magnetic fusion energy program is structured so as to be responsive to the many problems associated with a technology in such an early stage of development. The program activities and subactivities are not only concerned with the technical problems of demonstrating the scientific/technological/engineering feasibility of fusion, but also with the environmental and socioeconomic issues associated with the commercialization of fusion technology. Despite the fact that fusion technology is still in the early phases of the RD&D cycle, it is not too early to begin to address the issues that will be encountered when the technology enters the later demonstration and commericalization phases. Thus, it is instructive to compare the structure of the issue areas within magnetic fusion R&D to the budget activity and subactivity structure. Such a comparison will demonstrate that there is at least one, and in many instances more than one, subactivity that addresses the key technical and environmental issues and socioeconomic issues of commercialization of fusion energy.

TECHNICAL ISSUES

Plasma Behavior.—The analytic and computational capability to predict plasma behavior under a wide variety of conditions needs continuing development. Of special interest are magnetic field changes, long pulses, impurities, cross-sectional area, and shape.

Scaling Laws.—The ability to scale up the present generation of experiments to larger experiments and prototype reactors must continue to be developed and validated.

Prototype Development.—The various fusion power concepts (tokamak, mirror, etc.) require more experimental and theoretical development in order to evaluate their feasibility as prototypes upon which to build a more realistic, commercial-sized reactor design.

Technology Development.—Some of the technological obstacles include the development and construction of large and powerful superconducting magnets, the creation and maintenance of very high vacuums, the heating of fusion fuel to ignition temperatures, and the refueling of burning plasmas.

Engineering Issues.—Practical fusion power will require facilities operating at high reliability and availability. Considerable attention and ingenuity is necessary to develop designs with sufficient access, maintainability, simplicity, fabricability, etc., to reach the reliability and availability goals.

Materials Behavior.—Structural materials must be developed which will have long lifetimes in a fusion reactor environment (high temperature and large flux of energetic neutrons). Some extrapolation can be made from measurements in fission reactors, but new dedicated testing facilities are required.

Fusion Engineering Test Facility.—Careful examination of possible technical options with regard to device requirements must be considered and weighed versus costs, future data needs and time frame in which operation is desired.

NON-TECHNICAL ISSUES

Industrialization.—It is important to begin the technology transfer necessary for the eventual industrialization of fusion power development.

SUMMARY OF COMMITTEE ACTIONS

The Committee increased the Administration's request for authorization for the Magnetic Fusion Program by $43.043 million. The Committee changed operating expenses and capital equipment as follows: Confinement Systems, $2.5 million decrease; Development and Technology, $8.5 million increase; and Planning and Projects, $11.0 million increase. The Committee increased construction for all subprograms by $25.86 million. The Committee added $.183 million to program direction to allow for adequate travel and program review expenses which are severely needed in order for the 47 staff members to properly manage over $400 million worth of projects. This increased funding brings this program's expense account into a commensurate position with respect to other DOE programs of equal programmatic responsibility.

(a) CONFINEMENT SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Tokamak systems	62,050	71,900	----------	−4,500	67,400
Magnetic mirror systems	28,040	33,200	−3,800	0	33,200
Subtotal, operation expenses	90,090	105,100	−3,800	−4,500	100,600
Capital equipment: Facility opertions	15,805	18,300	−200	+2,000	20,300
Construction:					
Authorization	11,100	34,900	−2,500	+17,100	52,000
Budget authority	11,100	7,900	−2,500	+4,500	12,400
Total authorization		158,300	−6,500	+14,600	172,500
Total budget authority	116,995	131,300	−6,500	+2,000	133,300

[1] Indicates changes to original fiscal year 1981 B/A request.

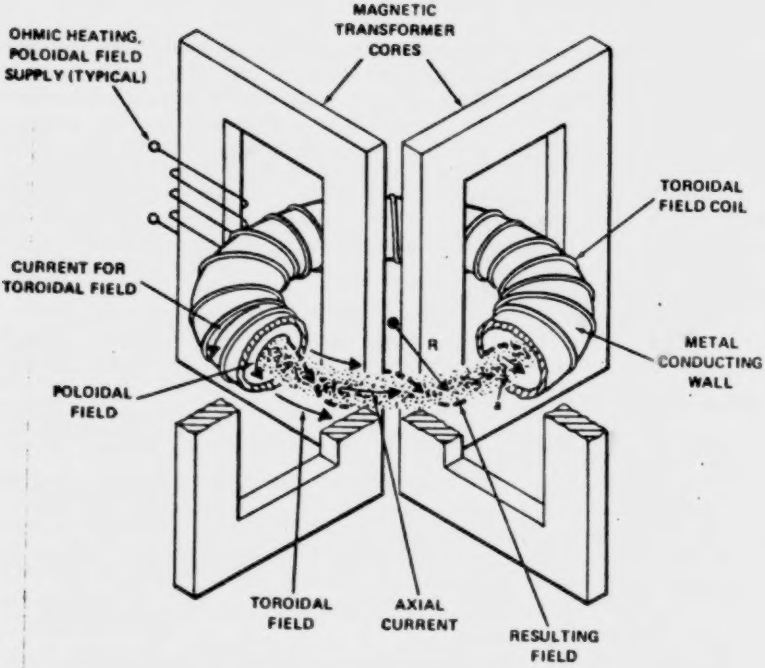
The Confinement Systems budget activity covers the design, fabrication, and operation of proof-of-principle experiments for tokamak and mirror systems. It has two subactivities: Tokamak systems experiments; and magnetic mirror systems experiments, which includes bumby torus research.

All tasks and subtasks within the two subactivities are managed by the Office of Fusion Energy's Division of Magnetic Confinement Systems.

TOKAMAK SYSTEMS EXPERIMENTS

Tokamak Concept

The Tokamak concept is to contain a stable, high temperature plasma in an evacuated torus (doughnut-shaped container). However, the wall of the torus is not used to confine the plasma. Confinement is accomplished by three different magnetic fields: the toroidal field, the poloidal field, and the equilibrium/stability field. The toroidal magnetic field, which is directed around the inside of the torus, is the basic confining field. It is produced by coils of wire wrapped around the body of the torus. The poloidal field produces magnetic pressure which forces the plasma toward the middle of the toroidal ring. It has a circular shape in each radial cross-section perpendicular to the plane of ring. The poloidal field is generated by a plasma current made to flow inside the toroidal ring by increasing the electrical current in the magnetic transformer coils. The toroidal and poloidal fields combine to produce the total "resulting" magnetic field shown in the figure. A third set of magnetic fields, used to maintain plasma equilibrium and stability, is generated by smaller coils that run along the outside periphery of the torus (not shown in the figure).


OHMIC HEATING, POLOIDAL FIELD SUPPLY (TYPICAL)
MAGNETIC TRANSFORMER CORES
TOROIDAL FIELD COIL
CURRENT FOR TOROIDAL FIELD
METAL CONDUCTING WALL
R
POLOIDAL FIELD
TOROIDAL FIELD
AXIAL CURRENT
RESULTING FIELD

Schematic diagram of a Tokamak device

Three different techniques are used to heat the plasma. Initial heating is provided by the plasma current (axial current), which also supplies the poloidal magnetic field. Further heating occurs by either the injection of high energy deuterium atoms (called neutral beam injection) or by transferring energy to plasma electrons or ions through RF or microwave electromagnetic radiation.

Overview of the tokamak systems experiments subactivity

The objectives of tokamak development are to demonstrate the scientific feasibility of the tokamak concept and then to exploit that concept for commercial reactor development.

The program strategy is to develop a mainline of devices (moderate magnetic field, circular cross-section, and neutral-beam heated) while concurrently developing and testing variants of these designs, the results of which influence the design of the next mainline device. This approach exerts continuous pressure for attainment of the final objective while preserving an important degree of flexibility for obtaining an optimum final reactor design.

The tokamak effort has been focused on five critical areas:

Plasma heating;
Plasma transport and scaling;
Plasma shape optimization:

Impurity control; and
Fueling.

Plasma heating concerns techniques for getting enough energy into the plasma to produce high plasma temperatures (e.g., ignition temperature). Plasma transport and scaling determines relationships between device parameters (e.g., plasma radius and heating power) and performance parameters (e.g., temperature, Lawson Product, and power balance, Q) that allow prediction of plasma behavior in more advanced devices. Shape optimization refers to finding the best cross-sectional plasma shape and impurity control concerns techniques to prevent plasma cooling by particles sputtered from the vacuum chamber wall. Fueling refers to the injection of additional fuel into the plasma without undue cooling.

The experiments within the Tokamak System subactivity are:

PLT—Princeton Large Torus to investigate tokamak scaling and provide a technology/diagnostic development base for the Tokamak Fusion Test Reactor (TFTR).

PDX—Poloidal Divertor Experiment to examine impurity control by magnetic methods and to investigate the effects of changing plasma shape.

ISX—Impurity Studies Experiment for the study of nonmagnetic impurity control and the investigation of stability and transport properties of high-beta, non-circular plasmas.

D-III—Doublet experiments to study properties of plasma with non-circular cross sections.

Alcator A/C—Alcator experiments to examine properties of hot, high density plasmas.

The relationship of these tokamak experiments to the problem areas is given in the following table, which shows the prime contractors and operational status of each experiment. Descriptions and status reports for each of these experiments follow:

RELATIONSHIP BETWEEN TOKAMAK EXPERIMENTS AND CRITICAL AREAS

Device or experiment Contractor	PLT PPPL	PDX PPPL	ISX ORNL	DIII GA	ALC–A MIT	ALC–C MIT
PROBLEM AREAS						
Heating	4	2	4	2	4	2
Transport and scaling	4	----	4	4	4	4
Shape optimization	----	4	4	4	----	----
Impurity control	----	4	4	4	----	----
Fueling	----	4	4	4	----	----

KEY ffO SYMBOLS

4—Operational applicable experiments in progress.
3—Operational applicable experiments in preparation.
2—Under design construction or major modification.
1—Proposed device considered critical for achieving the element objective.

Princeton Large Torus

The PLT is a mainline tokamak device forming a critical intermediate step between a small-scale, exploratory tokamak device, and a machine that will possess a number of commercial reactor characteristics (TFTR). The primary PLT project objective is to determine how plasma parameters (e.g., density, temperature, and confinement time) vary as machine size and heating power increase. In addition, PLT provides a test bed for high power neutral beam and RF heating experiments, and numerous technology and instrumentation experiments needed for the TFTR.

Status

The primary emphasis of experiments to date has been to investigate plasma stability and microscopic transport properties, to demonstrate how plasma parameters change with device parameters, and to establish a data base of plasma properties and diagnostic (measurement) techniques to help with TFTR development.

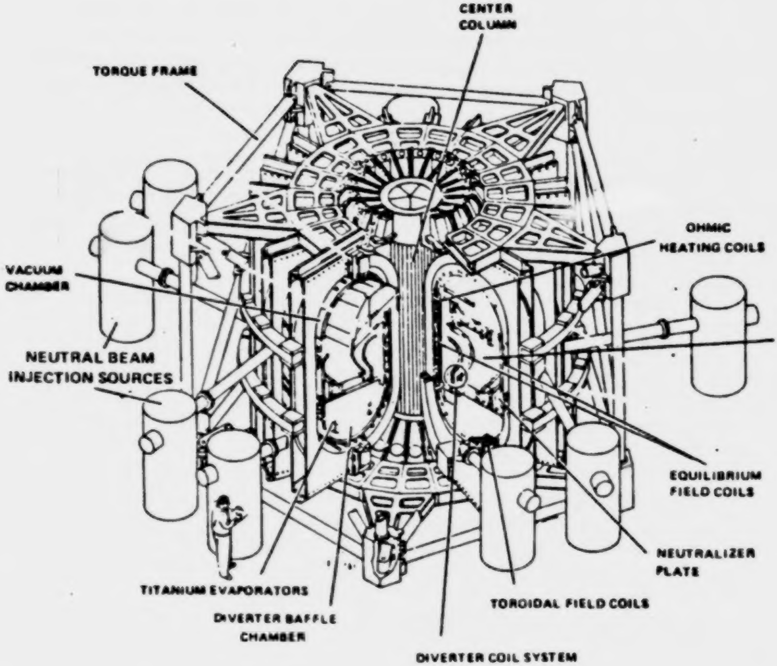
Initial experiments, using ohmic heating, showed how the Lawson Product depended on torodial radius and plasma density. In the spring of 1978, a plasma with an ion temperature of 6 keV (to be compared with 10–15 kev needed for a reactor) was achieved using four neutral-beam injectors which provided 2 MW of heating power. At these temperatures, the plasma entered the reactor regime for the first time and demonstrated better confinement than theoretically anticipated.

PLT will be used to test RF heating, a technique which may be significantly more efficient than neutral-beam injection. Installation of 2 MW of RF heating was completed in December 1978. Initial results from experiments conducted during FY 1979 and 1980 indicate that RF heating is comparable to neutral beam heating. Future work on PLT will investigate coupling RF energy into a tokamak plasma at a variety of frequencies and powers in an effort to optimize the RF heating technique.

Poloidal Diverter Experiment (PDX)

In order to attain the plasma temperatures of up to 10 keV estimated for a commercial reactor, plasma cooling must be reduced. One important way a plasma can cool is by the influx of "cold" particles (impurities) which have been sputtered from the container wall by plasma ions. This type of plasma cooling can be significantly reduced by magnetically diverting the incoming impurities into a collection chamber (separated from the plasma) before they interact with the plasma. The investigation of this magnetic diversion of impurities is the primary objective of the Poloidal Diverter Experiment (PDX). Other important objectives of PDX are to investigate impurity control by experimenting with different startup modes, and to evaluate the stability of a D-shaped plasma (the use of a plasma with this shape could lead to a significant reduction in the amount of magnetic field needed for confinement).

The plasma in the PDX device will be initially heated by the circulating current within the plasma (resistance heating). It will be necessary to add 6 MW of neutral beam power to evaluate magnetic diverter performance on reactor-grade plasmas. This additional heating power, combined with the expected reduction in cooling by impurities, should yield plasma temperatures (at reduced densities near the temperature required for energy breakeven).


CENTER COLUMN
TORQUE FRAME
OHMIC HEATING COILS
VACUUM CHAMBER
NEUTRAL BEAM INJECTION SOURCES
EQUILIBRIUM FIELD COILS
NEUTRALIZER PLATE
TITANIUM EVAPORATORS
TOROIDAL FIELD COILS
DIVERTER BAFFLE CHAMBER
DIVERTER COIL SYSTEM

Schematic diagram of the PDX device

Status

PDX will investigate impurity control with a variety of magnetic divertor coil configuration. Experiments at lower temperatures using ohmic heating have started. Initial results from these experiments are positive. The scrape off region of the plasma discharge has been successfully diverted to the collection chamber without significantly degrading plasma stability. Power loss from impurity radiation was reduced by 75%. Experiments on ohmically heated plasmas will continue. During FY 81, the neutral beam injectors will become operational and impurity control of high temperature plasmas will be investigated.

Doublet—III

The power produced by a tokamak fusion reactor can be significantly increased by raising the density and temperature of the plasma. Large increases in these parameters occur for the same confinement magnetic field when the plasma shape is varied. The variation of plasma shape by using special magnetic fields is the basis of the Doublet experiments.

The primary objective of the Doublet subtask is to determine the best shape for the plasma by comparing the stability and equilibrium of different plasma shapes.

The Doublet III device will be used to study the effect of plasma shape on confinement time and plasma transport properties. This device, is the initial operating stage at General Atomic Company. The plasma temperature resulting from ohmic (resistive) heating alone should be high (about 2 keV). Additional large amounts of neutral beam injection (20 MW) will produce a very high temperature plasma that should behave in a fashion similar to a reactor plasma. The resulting Lawson Product should be the same as that of a device which has reached energy breakeven.

Status

Doublet III (D–III) will provide reactor-like conditions for the comparison of various plasma shapes. D–III began operation in February 1978 at a fabrication cost of $31.0M. Initial experiments (through FY 1980) will evaluate different plasma shapes using ohmic heating. High temperature plasma experiments, using up to 7 MW of neutral beam injection power, will be completed by the end of FY 1981.

A recent D–III upgrade agreement has been reached with the Japanese. The Japanese will fund a machine upgrade to expand the D–III capabilities in exchange for experimental time on the facility. This upgrade will bring D–III near to its designed limits which may demonstrate equivalent break-even conditions in a hydrogen plasma. The Japanese experimental team is already on site conducting successful work on the shaped plasmas.

Impurity Studies Experiment

The influx of "cold" impurities into a hot plasma can cause significant plasma cooling resulting in plasma instabilities. This condition makes the attainment of a reactor-type plasma considerably more difficult, if not impossible, to achieve. The ISX device was originally designed to study techniques that do not use additional magnetic fields (unlike PDX) in order to control the influx of impurities. One such technique is impurity flow reversal where the inward migration of impurities is empeded by the flow of hydrogen gas around the edge of the plasma.

The original ISX experiment was recently modified (ISX–B) and the focus of the experimental program was changed. The primary objective of ISX–B is to investigate the stability and transport properties of non-circular, high-beta (high confinement efficiency) plasmas. Additional objectives for this device include understanding impurity flow reversal control, an evaluation of ripple injection heating, a feasibility demonstration of electron-cyclotron resonance heating, testing pellet fueling, and appraising limiter materials. (A limiter is used to shape the plasma.)

Status

The ISX device was fabricated at a total cost of $2.5M, and operated until March 1978 at ORNL. Between March and August, 1978, the device was modified to add 1.8 MW of neutral beam power, the vacuum vessel was changed, and a new poloidal field coil system (to permit shaping of the plasma by magnetic fields) was added. This modified ISX device is now designated ISX–B.

FY 1979 ISX–B experiments included the dependence of plasma confinement on plasma shape and beta value; determination of stability beta limits for plasmas subject to neutral beam heating; the general effect of neutral beam heating when the injected power is 5 to 10 times the ohmic (resistive) heating; and a continuation of flow reversal impurity control experiments. ISX–B achieved a record 2.1% average β in a Dee shaped plasma. Plasma stability exceeded predicted values.

In FY 1980, additional neutral beam heating (for a total of 3 MW) will be used to investigate plasma properties at high values of confinement efficiency (beta about 10%). ORNL will design and construct a bundle divertor for ISX–B; this device may be needed to control the flux of impurities anticipated with the addition of 3 MW of neutral beam power. Microwave heating experiments using 200 kw of power will begin in FY 1980.

Alcator

The Alcator concept provides the basis for a smaller fusion reactor design. Reactor-grade plasmas can be obtained by using large magnetic fields and a small plasma cross-sectional area to produce high density (with corresponding large values for the Lawson Product).

The primary objective of the Alcator subtask, which is being performed at MIT, is to explore the relationship between plasma characteristics (e.g., temperature, confinement time) and plasma density. Alcator A, a small tokamak device, has proven to be capable of a broad range of operating densities (the highest densities are more than 300 times the lowest densities). A new device, Alcator C (Figure III–13) has approximately twice the effective plasma radius of the existing machine, and has improved access for diagnostics (or for RF heating). With the addition of a new power supply, the device should achieve an almost 50 percent increase in maximum magnetic field over Alcator A. The resulting increase in plasma density combined with the effects of heating from a high plasma current should lead to a value of Lawson Product required for energy breakeven.

Status

In FY 1978, Alcator A was used to explore plasma behavior in high magnetic fields. These experiments obtained record values for a Lawson Product (3×10^{13} cm^{-3}-sec). The primary emphasis in FY 1979 is on the development of plasma diagnostics and instrumentation to aid in completing Alcator C which began operation in June 1978 at a total fabrication cost of $6.7M.

Preliminary experiments are in progress on Alcator C. The first high magnetic field experiments will begin by April 1980. During FY 1980, Alcator C will be routinely operated at high magnetic fields which should lead to the highest value of the Lawson Product ($\sim 10^{14}$ sec–cm^{-3}) obtained by any tokamak experiment.

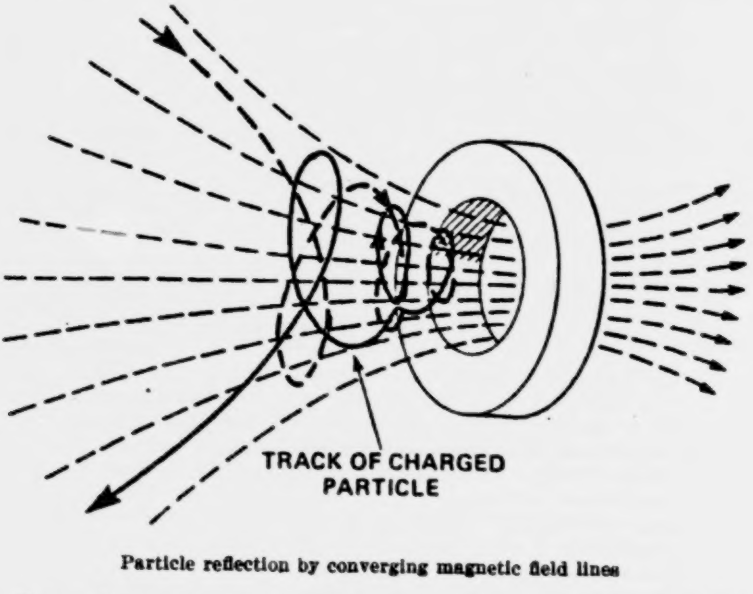
In FY 1980, two forms of RF heating will be tested on Alcator C. The first, lower hybrid heating, is expected to provide 1 MW of heating power by September 1980, with up to 4 MW the following year; the second, ion cyclotron heating, will serve as an alternate heating scheme for Alcator C. Up to 8 MW of surplus radar equipment is ultimately available for this approach. If either of these heating methods is effective, temperatures in excess of 4 keV will be obtained.

MIRROR SYSTEMS EXPERIMENTS

Magnetic Mirror Concept

Magnetic mirror systems rely on the property of converging magnetic field lines to reflect ("mirror") plasma particles. The increasing density (intensity) of the field lines at the ends of the device produces a force which tends to reverse the motion of the escaping particles. A simple magnetic mirror in which plasma is partially trapped between two coils has a high leakage rate both axially through the coils for plasma particles whose motion is close to being along the axis of the device and radially outward due to instabilities associated with the outward bending of the magnetic field lines. The simple mirror by itself is not a viable reactor concept.

A better technique of mirror confinement is the minimum-B or Yin-Yang concept. This magnet creates a magnetic "well" in the center of the device (the magnetic pressure is minimum in the center increases in all directions in the region where the plasma is located) which helps to stabilize the plasma. The leakage rate of plasma from the ends of the device, however, is substantial.



Particle reflection by converging magnetic field lines

Two primary concepts are being pursued in order to reduce end losses in mirror systems. The first concept is the tandem mirror in which two minimum-B mirrors are placed on either end of a long solenoid (a cylindrical coil). Positively charged plasma ions are held radially in the central solenoid region by the solenoidal magnetic field and axially by electrostatic forces generated by the positive charge which builds up in the end mirrors. Heating is supplied to the mirror end cells by neutral beam injection. In the second containment concept, field reversal, reduced plasma losses occur when the magnetic field lines around the plasma are made to close on themselves (field lines effectively reverse direction). Since charged particles tend to follow magnetic field lines, the closing of lines in the plasma helps to trap the particles. Neutral beam heating is thought to be capable of sustaining the field-reversed state once it is established.

Overview of the Magnetic Mirror Systems Subactivity

The highest priority problem in the Mirror subactivity is to improve the power balance, Q, the ratio of energy produced by the fusion to the energy required to attain fusion. The strategy of the mirror program is to address this problem aggressively through the tandem mirror and field reversal concepts, while at the same time developing a scaled-up standard mirror device to serve as a reactor prototype for technology development. If either the tandem mirror or the field reversal concept appears to be a viable reactor concept, the scaled-up mirror device will become the key technological cornerstone for a prototype reactor design based on one or the other of these concepts.

The experiments/facilities in the Mirror Systems subactivity are:

Beta II—Experiment to investigate the reversal of magnetic fields deep in the plasma.

TMX—Tandem Mirror Experiment to investigate the scientific feasibility of the tandem mirror concept.

Phaedrus—A tandem mirror device used to support the larger tandem mirror experiment by developing the RF heating option.

FRX—Field Reversal Experiments to investigate the stability and confinement properties of the reversed-field plasma state.

Constance II—Facility to study stabilization techniques (applicable to minimum-B mirrors) and auxiliary (electron) heating methods.

MFTF—Facility to support experiments on a scaled-up minimum-B magnet. The facility could be used for large-scale experiments based on the field reversal and tandem mirror concepts.

STM—Experiment to examine the feasibility of plasma similar to EBT annuli to stabilize a simple magnetic mirror configuration which may then be used as an end plug in a tandem mirror.

EBT—A bumpy torus device in which the plasma is heated by microwaves and stabilized by hot electron rings.

The critical study areas for the Mirror Subactivity are:

Confinement scaling;
Q-enhancement;
Heating; and
Steady-state operation.

Q-enhancement refers to techniques whereby a device will produce power more efficiently either through the reduction of energy losses from plasma leakage or through the attainment of plasma ignition (self-sustained burning). Confinement scaling and heating were discussed under Tokamak Systems Experiments. Steady-state operation means a device can operate in a continuous fashion, hence eliminating cyclic wall fatigue and producing continuous power as required by a utility grid.

RELATIONSHIP BETWEEN MIRROR EXPERIMENTS AND CRITICAL PROBLEM AREAS

Device or experiment	Beta II	FRX	TMX	Phaedrus	Constance II	MFTF (MFTF-B)
Contractor	LLL	LASL	LLL	University of Wisconsin	MIT	LLL
Problem areas:						
Q—Enhancement	4	4	4	3		2
Confinement scaling	3	4	4	3	3	2
Heating	2		4	3	3	2
Steady state						2

Key to symbols:
4 = Operational, applicable experiments in progress.
3 = Operational, applicable experiments in preparation.
2 = Under Design, construction or major modification.
1 = Proposed, device considered critical for achieving the element objective.

Beta II

The Beta II experiment uses a minimum-B type magnet (from the 2X–IIB experiment) to test operating procedures for the large minimum-B magnet in the MFTF, and to study the reverse field concept. The Beta II device consists of two Yin-Yang magnet coils. These special coils produce a magnetic well which helps to stabilize the hot 13 keV) plasma generated by the perpendicular injection of 12 neutral beams onto a warm (0.1 keV) plasma stream. The warm stream, injected from the ends of the device along the magnetic field lines, serves both as a neutral beam target and as a stabilizing mechanism to reduce plasma turbulence which limits the time that the plasma can be contained.

The primary Beta II objectives are to investigate single-cell (classical mirror) physics questions related to the MFTF, including startup and stability, and to continue field reversal experiments, using a magnetized coaxial plasma gun. The field reversal confinement technique, if successful, could lead directly to designs for a small prototype commercial reactor. The Beta II technology goals directly support the new and larger Tandem Mirror Experiment (TMX) and the much larger MFTF.

Status

The basic investigations of the minimum-B (Yin-Yang) mirror concept were carried out at LLL using the 2X–IIB experiment device. Reconfiguration of 2X–IIB into Beta II was completed in fiscal year 1979.

During its last year of operation, 2X–IIB was used for radial size scaling, field reversal, and plasma stabilization experiments. In the radial scaling experiments, the ratio of radial plasma size to characteristic particle orbit size was increased from 2 to 6. Both the Lawson product and the electron temperature increased for constant beta. The field reversal experiments bordered on producing the field reversed state by using 7 MW of injected neutral beam power.

Recent theoretical calculations of field reversal indicate that either the energy confinement time or the injection power will have to be substantially increased (by a factor of 3) to achieve field reversal using neutral beam injection. As a result, experiments will be pursued in Beta II to establish a reversed field plasma state which will be sustained by neutral beam injection. The experiments based on this technique have been initiated.

Tandem Mirror Experiments (TMX)

The fusion power produced in a conventional (minimum-B magnet) mirror reactor is almost equal to the neutral beam heating power injected (i.e., Q is almost unity). In order to achieve higher reactor Q values, a tandem mirror uses as basic components two conventional mirror machines placed at either end of a solenoid (cylindrical coil). The conventional mirrors act as "plugs" to increase the plasma confinement time in the central portion of the solenoid. This function is accomplished by a positive electrostatic potential which builds up in the end mirrors as a result of an initial loss of electrons from the plasma.

The objectives of TMX are to demonstrate that the tandem mirror concept will lead to significantly larger values of energy gain Q (between 5 and 10) and will provide a basis for a technically viable fusion reactor. Once this is shown, the program objective will be to develop a tandem mirror design that can be readily scaled up to produce near-commercial, reactor-like plasma characteristics.

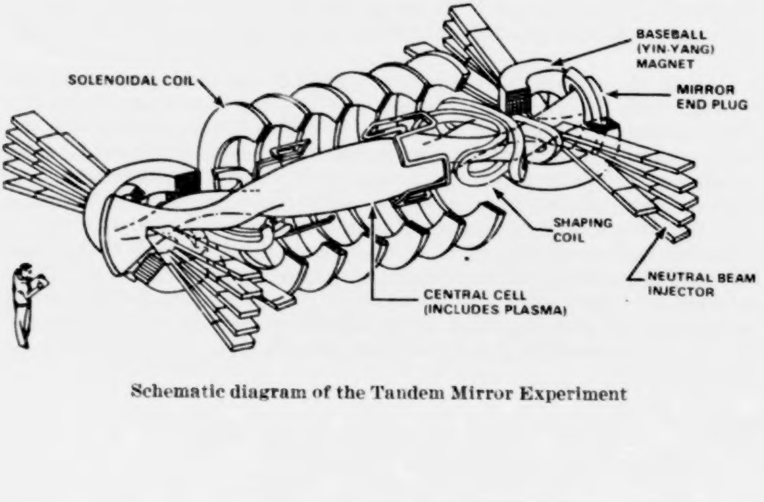
Status

The tandem mirror concept was developed during 1976 through independent efforts in the Soviet Union and in the United States. TMX was approved and fabrication began in 1977. The total construction cost was $11.4M. Installation of the mirror plug tanks began in April 1978, and some equipment was transferred from 2X–IIB (also at LLL) in June 1978. TMX became operational in early FY 1979 with initial experiments aimed at the following near-term goals:

Demonstrating the existence of a magnetic potential well in the solenoid region between the two mirror plasmas.

Developing a magnetic geometry which can be scaled up in a larger device to confine a high temperature, high density, reactor-grade plasma.

Investigating the microstability of the plug-solenoid combination in order to maximize the system energy gain, Q.



Schematic diagram of the Tandem Mirror Experiment

Phaedrus

Phaedrus is a tandem mirror device (similar in design to TMX but smaller) which will be used to develop RF heating for the TMX. If the RF heating experiments are successful, this technique could lead to a large reduction in the neutral beam heating required for a tandem mirror reactor and would significantly decrease technology requirements and costs. Phaedrus will also be used to explore the trapping of plasma (i.e., reactor refueling) by RF techniques.

Elmo Bumpy Torus

The Elmo Bumpy Torus concept is that of linking many "simple" mirrors in series to form a torus so that individual mirror magnetic field lines can be joined to eliminate end losses. EBT is an attractive reactor concept, with such features as steady-state operation, ignited plasma, low magnetic fields, relatively simple technology, ease of maintenance, and modular design. EBT uses microwave power for creating, heating and stabilizing (by means of hot electron rings) the plasma. The density, temperature and lifetime of the plasma are directly related to the frequency and power of the applied microwaves. Present programs are aimed at testing these scalings and at testing supplementary ion heating by means of ICRH.

COMMITTEE ACTION

Confinement Systems—$14.6 million increase

The Committee approved a $2 million increase to provide for procurement of diagnostic apparatus for the Tokamak Fusion Reactor (TFTR) at the Princeton Plastma Physics Laboratory. This is essential, so that as many diagnostics as possible will be present on TFTR during its initial start-up and "shake-down" phase.

In accordance with the Committee's policy, the modification of the Impurity Studies Experiment (ISX-C) was transferred from Confinement Systems operating expenses to construction (Project 81-MF-2). This resulted in a $4.5 million transfer from operating expenses to construction. In addition, the Committee added $5.5 million to ISX-C construction for a total of $10 million.

The Committee increased the Elmo Bumpy Torus (Project 80-MF-3) by $7.1 million to provide a 2-year authorization.

(b) Development and Technology

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	To authorizati
Operating expenses:					
Magnetic systems	13, 020	10, 700		+4, 000	14, 70
Fusion systems engineering	11, 540	15, 900		+1, 000	16, 90
Plasma engineering	9, 500	16, 300	−1, 000	+2, 000	18, 30
Fusion reactor materials	10, 490	14, 500			14, 50
Environment and safety	1, 650	3, 000			3, 00
Fusion energy applications	1, 800	3, 200			3, 20
Subtotal, operating expenses	48, 000	63, 600	−1, 000	+7, 000	70, 60
Capital equipment: Facility operations	6, 050	8, 700		+1, 500	10, 20
Construction:					
Authorization		6, 690		−190	6, 50
Budget authority	2, 000	6, 500		0	6, 50
Total authorization		78, 990		+8, 310	87, 30
Total budget authority	56, 150	78, 800		+8, 500	87, 30

[1] Indicates changes to original fiscal year 1981 B/A request.

The Development and Technology budget activity is managed b the Office of Fusion Energy's Division of Development and Technology. This activity has a two-fold mission:

To provide systems engineering and component developmen support to current plasma devices and future fusion reacto programs.

To develop the broad technology base necessary for fusio energy to become a commercial reality.

To accomplish these objectives, the Development and Technolog activity is organized into six subactivities:

Magnetic Systems.—Provides engineering design and component development of large superconducting magnets and pulsed power systems to support TFTR, major scaling experiments, and future systems such as ETF.

Plasma Engineering.—Focuses on the design and component development of efficient plasma heating systems including neutral beams and microwaves; also addresses methods of recovering energy from beams of charged particles and the development of fueling and particle collection techniques.

Fusion Reactor Materials.—The selection, testing, and evaluation of candidate materials for fusion reactor components. Of particular concern is the long-term stability of the first wall which will be subject to severe neutron irradiation during reactor operation.

Fusion Systems Engineering.—Development of conceptual designs for fusion reactor facilities and addresses engineering design and development of critical supporting subsystems.

Environment and Safety.—Assures that the development and ultimate operation of fusion power reactors is accomplished with minimum adverse effect on the environment and with maximum safety for both the public and operating personnel.

Fusion Energy Applications.—Evaluates the role of fusion energy in non-electrical applications.

Magnetic Systems

The major purpose of the Magnetic Systems subactivity is the engineering design and component development of large super conducting magnets and pulsed power systems. The subactivity has two tasks: Superconducting Magnetic Development (FY 1981 BA request—16.3M) and Energy Storage and Transfer (FY 1981 BA request—8.4M). (All quoted funding levels are from original DOE request.)

The Superconducting Magnet Development task is developing superconducting wire and cable, magnet construction techniques, and an industrial magnet production capability to support large fusion experiments. The major effort is the tokamak-oriented Large Coil Project (LCP) at ORNL entailing the fabrication of six superconducting coils and the construction of a Large Coil Test Facility (LCTF), for testing and evaluating these magnets (as well as future large magnets). Other activities include high-field superconductor development in support of the Mirror Systems, and the development of high magnetic field conductors using the High Field Test Facility (HFTF) at LLL.

The Energy Storage and Transfer task is developing the components and systems necessary to produce special magnetic or electrical fields which initiate or control plasmas. Pulsed superconducting magnets, and vacuum breaker switches are examples of components being developed for tokamak ohmic heating and vertical field systems.

Status

The LCP, the major project under the Superconducting Magnet task, is proceeding on schedule. In FY 1979, final designs for the test coils will be completed and short samples of the super-conducting cables will be evaluated. United States industry have begun fabrication of three of the six coils (Japan, Switzerland, and Euratom will build the other three) at a cost of $20M with delivery of two coils in 1981. The LCTF at ORNL, with an estimated cost of $22M (not including the coils), will begin initial operation in late 1980 with a capability of testing three coils without a pulsed magnetic field environment. Full operation will begin in 1982.

The HFTF at LLL became operational in FY 1978 and was utilized to test the MFTF conductor. The HFTF capability will be increased to its highest magnetic field capability in 1980 and will enable high field testing of superconductors which may be used in tokamaks and mirrors.

Under the Energy Storage and Transfer task, testing of small, pulsed superconducting energy storage coils at LASL and Argonne have demonstrated that it is time to move to larger systems to support the Engineering Test Facility needs. Efforts are under way to build and test a 20MJ pulse coil. The coil will be constructed in industry, and a pulse test facility is being constructed at LASL.

Plasma Engineering

The main thrust of the Plasma Engineering subactivity is the design and component development of efficient plasma heating systems which use neutral beams and microwaves. There are five tasks under this subactivity:

Neutral Beam Development ($10.35M).
RF Heating System Development ($4.5M).
Plasma Direct Energy Conversion ($0.15M).
Vacuum and Particle Collection ($0.7M).
Fueling ($0.6M).

The FY 1981 BA request is given following each task listing.

Neutral beam heating involves the formation and injection of streams of high-energy deuterium atoms into plasmas. Neutral Beam Development is directed at developing higher-energy, higher-efficiency, and higher-reliability systems which directly affect TFTR and MFTF. The program further includes design support and prototyping efforts for confinement systems users, and the neutral beam test stand operation at ORNL and LLL/LBL.

Under RF Heating System Development, the principal effort is the industrial development of gyrotron millimeterwave tubes. Applications include bulk heating, ionization and breakdown, and profile control of plasmas in tokamak, mirror and EBT devices and heating of the relativistic electron rings in EBT. Activities also will be undertaken to develop the technology associated with lower frequency heating methods.

Plasma Direct Energy Conversion is developing methods and hardware for direct energy recovery from plasma exhaust. Direct conversion recovers otherwise lost power, and reduces the performance requirements for plasma dump systems. In addition, plasma direct conversion may make mirror fusion reactors more efficient and may be applied to direct recovery of tokamak divertor exhaust.

The Vacuum and Particle Collector task provides the engineering data and technology base for vacuum components and divertor collector systems. Near-term emphasis is on qualifying techniques for large-scale helium and tritium pumping and on the formation of a divertor development program.

The Plasma Fueling task develops fueling techniques and hardware for longer pulsed fusion reactor systems. Near-term emphasis is on development of a solid hydrogen pellet injector for testing on PLT, Doublet III, PDX and TFTR.

Status

The PLT-style neutral beam source has been modified and demonstrated at twice its present power rating for use in ISX and PDX. The prototype neutral beam sources for TFTR and Double III have been operated at full power. Negative ion sources are being examined for later testing.

Millimeter wave heating efforts in FY 1980 include operation of the 286 Hz gyrotron on EBT–S and development of 60 Hz gyrotrons for tokamaks (for bulk heating and profile control), mirrors, and EBT–P. Tests are scheduled for ISX in 1980.

Plasma energy conversion efficiencies of 75 percent have been demonstrated on a test stand at LLL. Configurations oriented toward tandem mirror plasma devices will be tested in 1980.

Vacuum technology efforts in 1980 include the development and fabrication of large compound cyropumps for testing in the Tritium Systems Test Assembly plus a new effort at MIT to begin development of test components for particle collection in tokamak divertors. Initial applications may be in ISX and PDX. A Vacuum Components Test Facility is being considered for the future to focus development efforts at a single location.

Plasma fueling work will be focused on the development of "pellet" injector systems. Recent pellet fueling experiment on ISX have resulted in greatly increased confidence in the viability of pellet injection for reactor fueling.

Fusion Reactor Materials

Successful operation of commercial fusion reactors will require the development of materials capable of withstanding the severe radiation environment resulting from the D–T fusion reaction. Critical problems are the long-term stability of firstwall and related structural materials, and the attendant influence of those materials (as impurity sources) on the plasma. The principal objective of the Fusion Reactor Materials subactivity is the solution of these problems utilizing the following tasks:

Alloy Development for Irradiation Performance ($5.18M).
Plasma Materials Interaction ($3.2M).
Special Purpose Materials Development ($0.58M).
Damage Analysis and Dosimetry ($2.715M).
Radiation Facilities Development and Operation ($2.65M).

The FY 1981 BA request follows each task listing.

The Alloy Development task is development of radiation-resistant first-wall and structural materials. A four-path program, pursuing austenitic alloys, nickel-iron-chromium alloys, reactive-refractory metals, and innovative concepts simultaneously, is directed at the long-term objective of commercial fusion power. The interim objective is to provide alloy selection data for the intermediate-term engineering prototype and demonstration power reactors.

The Plasma Materials Interaction task studies the interaction of plasma irradiation with the surface of the first wall. The objectives are to provide the data base necessary to deal with the plasma contamination problem and to minimize the detrimental effects on the first-wall material.

Special Purpose Materials deals with the development of fusion reactor materials other than first-wall and structural materials.

Damage Analysis and Dosimetry encompasses establishment of the radiation (primary neutron) spectra in various facilities, establishment of damage parameters and measurement of damage in materials, analysis of radiation damage resulting different neutron energies, and extrapolation to predict effects of the fusion power spectrum.

Radiation Facilities Development and Operations includes the development and operation of neutron and plasma sources to simulate the fusion reactor environment required for materials testing. Operation of the High Intensity Neutron Source (HINS) is beginning. Other work includes the conceptual design of the Fusion Materials Irradiation Test (FMIT) facility.

Status

FY 1978 accomplishments in Fusion Reactor Materials included the first data from HINS, extending high-energy neutron damage data by 2 orders of magnitude in exposure. The first tests of low atomic number, high-temperature coated limiters was performed in ISX. In situ diagnostics are being developed to further define impurity transport in tokamaks, and the first mechanical property data on irradiated titanium alloys was generated.

Plasma-Materials Interaction work FY 1980 includes completion of a comprehensive data base for impurity injection mechanisms for early D–T devices and selection of surface coating research reference materials. During FY 1979, titanium-di-boride and boron carbide coatings in graphite specimens survived thermal fatigue tests for up to 250 cycles with acceptable chemical and physicial erosion. Plasma testing of limiters in ISX–B began in September 1979.

The list of candidate materials for alloy development was expanded in FY 1979 to include ferritic (martensitic) steels. Recent studies have shown that magnetic considerations will not be a major barrier to the use of these materials in fusion reactors. A development program on ferritic steels is being initiated in FY 1980.

In FY 1980, work on long-range ordered alloys is being moved up from the research stage to an applied development stage.

Fusion Systems Engineering

This subactivity is focused on developing conceptual designs of future fusion facilities. Other efforts include the engineering design and development of critical supporting subsystems. There are six task areas:

Conceptual Design and Engineering ($7.5M).
Feasibility Assessment ($2.7M).
Blanket and Shield Engineering ($1.8M).
Tritium Processing and Control ($2.7M).
Plasma Systems ($0.5M).
Plant Systems ($0.7M).

The FY 1981 BA request follows each task listing.

The Conceptual Design and Engineering task was established in early 1976 to define and design the ETF, the major fusion facility which will follow the TFTR and MFTF. This task provides a near-term focus for the physics and technology tasks of the magnetic fusion program. The current strategy is to develop conceptual designs for ETF which can be considered as post TFTR and MFTF devices. The ETF will provide significant advances toward fusion power and will also provide a means of obtaining necessary engineering data and technology experience. Projects evaluate these designs in terms of technical risk, schedule and cost, and based on these evaluations, the Office of Fusion Energy will select and implement an appropriate design. Another element in the strategy is to address the need to develop an industrial base for fusion power commercialization.

The Feasibility Assessment task is assessing ongoing and near-term projects, and projections of the eventual nature of fusion power production.

Blanket and Shield Engineering is addressing the design and analysis of first-wall and blanket assemblies and is primarily oriented toward a far-term Engineering Prototype Reactor (EPR) or Demonstration Reactor (DEMO). Blanket engineering is critical to reactor success since this blanket is where the neutrons are converted into heat and tritium is produced.

Tritium Processing and Control efforts are focused on the TSTA which will be dedicated to the development, demonstration, and interfacing of technologies related to the D–T fuel cycle including the management of radioactive tritium for first generation fusion reactor systems.

The Plasma Systems Analysis task develops computational engineering tools for studying the interaction of plasma-related hardware such as neutral beam and RF heating systems, particle collection systems, and impurity control techniques. These tools are used in evaluating trade-offs among these and other plasma-related systems (such as fuel injectors) in order to minimize overall technological requirements.

The Plant Systems task addresses other fusion reactor subsystems including control system development, maintenance, energy transfer, and storage. The task also provides a detailed assessment of the remaining plant R&D requirements.

Status

In the Conceptual Design and Engineering area, the "next step" tokamak design and engineering studies were initiated in FY 1976 at ORNL. In FY 1977, General Atomic Company also began to develop a "next step" design as part of a Government-funded effort. In FY 1978, PPPL and MIT initiated tokamak "next step" studies based on a TFTR upgrade study that had been completed in FY 1977. In FY 1979 a single design team was established at a special design center located at ORNL made up of representatives of ORNL, PPPL, MIT, GA and major industrial partners. A mirror ETF design effort was initiated at LLL.

The conceptual design for the tokamak ETF should be completed in FY 1980–1982, and construction could start by FY 1984 with operation in FY 1990–1992. For the mirror ETF, conceptual design should be completed in FY 1981–1982; construction could start in FY 1984 with operation in the early 1990s. These dates are set up by the physics and technology base currently available to support a particular confinement scheme.

In the Feasibility Assessment task, studies of potential commercial tokamak and mirror power plants are under way at the University of Wisconsin, Lawrence Livermore Laboratory, and Argonne National Laboratory.

An assessment of alternate confinement techniques, including the EBT, is continuing at LASL as a backup to the mainline tokamak and mirror concepts.

In Blanket and Shield Design, neutron mockup experiments are under way at ORNL with detailed design of first-wall and blanket assemblies being addressed at ORNL and ANL. Additional shielding core work and blanket and shield engineering assessments are proceeding at LASL and ANL.

The TSTA concept originated in 1976 when the Division of Development and Technology concluded that consolidation and acceleration of tritium development were essential to provide adequate input to design of any major fusion experiment in the 1980's. At the end of FY 1977, LASL was authorized to construct TSTA at an estimated total cost of $13.5M. Construction proceeded on schedule throughout FY 1979 with installation of major TSTA equipment begun in June 1979.

Plasma Systems Analysis projects are centered at ORNL, and at the University of Illinois. The ORNL and SAI effort is focused on tokamaks and constitutes the major portion of this task. The University of Illinois effort is investigating plasma-related technology requirements for Reversed Field Mirror and Reversed Field Plasma configurations.

Environment and Safety

The objective of the Environment and Safety subactivity is to ensure that the development and ultimate operation of fusion power reactors is accomplished with minimum adverse effect on the environment and with maximum safety both for the public and of DOE and DOE contractor personnel and property. The present effort is geared strictly to D-T fusion power since it is expected that all near-term fusion power reactors will be of this type. The subactivity is divided into two tasks:

Environment Assessment ($1.6M).
Reactor Safety Research ($1.4M).

The FY 1981 BA request follows the definition of each task.

The Environmental Assessment task makes certain that: (1) environmental considerations are part of decisions to construct and operate major fusion facilities, and (2) the environmental impact of the fusion power R&D program is properly evaluated. An Environmental Impact Statement (EIS) is published for each major fusion facility.

The Fusion Reactor Safety Research task is concerned with identification, evaluation, and control of all potential hazards associated with the operation of major fusion R&D facilities and, ultimately, fusion power reactors. For each major fusion facility, a Preliminary Safety Analysis Report (PSAR) will be prepared prior to construction and a Final Safety Analysis Report will be prepared prior to operation.

The Environment and Safety research and development efforts are coordinated with the pace of the fusion technology program.

Status

In FY 1979, the fusion Environmental Development Plan (EDP) was updated, identifying the key environment and safety issues in magnetic fusion and establishing a plan for their resolution. A detailed plan for Fusion Reactor Safety Research is being prepared by INEL.

Preliminary work is underway for preparation of a generic EIS for magnetic fusion.

Fusion Energy Application

Recent studies have shown that without a substantial change in end-use energy technologies, the major energy demand after the turn of the century will in all likelihood continue to be non-electrical. Therefore, a subactivity was established to evaluate the role of fusion energy in non-electrical applications. This subactivity is divided into three tasks which address the major areas where fusion may contribute:

Synthetic Fuels ($2.0M).
Fusion Fission Fuel Hybrids ($1.0M).
Emergent Applications ($0.2M).

Status

A number of new projects to evaluate alternate fusion energy applications were begun in FY 1978. Initial results of hydrogen production studies indicated that the high-temperature electrolysis process and several thermochemical processes for producing hydrogen are the most attractive approaches selected. Studies initiated in these areas are being conducted in FY 1980. The other major emphasis is on fusion-fission hybrids. For these systems, it is the symbiotic relationship between the fusion and fission systems that results in the beneficial advantage of this configuration. An initial study of Pebble Bed Fusion-Fission Systems by General Atomic Company was completed in October 1978. Commercial reactor designs of tokamak and tandem mirror concepts were carried out in FY 1979 and the tokamak design is being completed in FY 1980.

COMMITTEE ACTION

Development and Technology—$8.31 million increase

This increase is essential to guide the program into the engineering technology phase of fusion energy development. The Committee's action to provide this funding for the conceptual design work on the Fusion Engineering Test Facility (FETF) in FY 1981 provides the necessary engineering and technology focus and dictates the simultaneous need for parallel technology development programs. This will insure an adequate data base for the FETF design. This funding will be used as follows:

$4.56 million for Plasma Magnetics which includes: Funding to maintain the Large Coil Project within cost, funding for superconducting magnet research (steady state and pulsed), and prototype FETF coil design. A technical adjustment to bring FY 1981 authorization to $6.5 million is included. This fully authorizes the project at $16.95 million.

$2.75 million for Plasma Engineering which includes: Advanced positive ion beam and test stand development, necessary research for radio frequency heating sources and transmission lines, studies of beam heating versus RF heating, and industrialization of fueling technology and pellet fabrication.

$1 million for Fusion Systems Engineering which will provide for initial development of thermal-hydraulic, thermo-mechanical, and electromagnetic testing of first wall, blanket and shield components and subassemblies.

(c) APPLIED PLASMA PHYSICS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Advanced fusion concepts	11,100	18,000		0	18,000
Fusion plasma theory	15,500	20,500		0	20,500
Experimental plasma research	11,947	15,900		0	15,900
National MFE Computer Network	11,153	11,400		0	11,400
Subtotal, operating expenses	49,700	65,800		0	65,800
Capital equipment: Facility operations	3,675	6,700		0	6,700
Total	53,375	72,500		0	72,500

[1] Indicates changes to original FY 1981 B/A request.

The Applied Plasma Physics budget activity, managed by the Office of Fusion Energy's Division of Applied Plasma Physics, is responsible for conducting proof-of-principle programs for fusion concepts other than tokamak and mirror systems, and for all base physics, including theory and computation. This activity is organized into four subactivities:

Advanced Fusion Concepts.—Develops fusion concepts which represent true alternatives to tokamaks and mirrors and which have the greatest promise of significant reactor advantages.

Fusion Plasma Theory.—Responsible for developing and applying physics models and mathematical techniques necessary to describe the behavior of magnetically confined plasmas under real operating conditions.

Experimental Plasma Research.—Responsible for providing experimental techniques and data and fundamental physics information required to operate and interpret present major confinement experiments.

National Magnetic Fusion Energy (MFE) Computer Network.—Provides the computing capability so essential for theoretical analyses, engineering calculations and data reduction. The network is a highly cost effective way of meeting the large-scale computing requirements and it provides a central focus for cooperative efforts.

Advanced Fusion Concepts

The Advanced Fusion Concepts subactivity supports experimental tests of fusion concepts which are alternatives to tokamaks and mirrors. An important factor that is becoming increasingly apparent in the fusion power development program is the convergence of various fusion approaches. This can be read as a maturing of the science as the various confinement configurations are unified by common underlying physical principles. This has two substantial consequences to the development program.

(*a*) Engineering and technology development programs directly relevant to the mainline confinement approaches are also relevant to many of the alternate concepts, and

(*b*) Experimental and theoretical advances in the mainline areas of heating, confinement physics, computational techniques, etc. are immediately transferrable to alternate concept research programs and vice versa. This is particularly true in the toroidal confinement concepts in which reversed field pinch, compact toroid configurations, and torsatrons have many similarities to the tokamak configuration.

The benefits of this convergence are that the cost of alternate concept development is reduced and the programs should be able to proceed at a faster development pace because of the successful experiences in the mainline efforts. As a corollary, funding of alternate concepts does *not* diffuse program emphasis. These activities are in a real sense intended to produce significant reactor advantages and improve the ultimate reactor configuration based on the convergence of the confinement approaches.

The concept areas presently supported include the reversed field pinch, alternate fuels/multipoles, torsatrons, and compact toroids. The compact toroid area includes spheromaks, field reversed configurations, and plasma rings.

Status

The status and plans for the various Advanced Fusion Concepts are given below.

The Elmo Bumpy Torus (EBT) concept, chosen as the leading alternate concept, has been moved into the proof-of-principle stage within the Confinement Systems activity.

The Reversed Field Pinch program, being supported primarily at LASL, is now the largest Advanced Fusion Concept Program. A major RFP device, ZT–40, costing approximately $10 million began operation at LASL in October 1979. Basic scaling results on performance versus size for the RFP approach will be obtained in FY 1980 and experiments will be extended to the long-pulse regime.

In the Alternative Fuels/Multipoles program, the emphasis in FY 1979 has been to upgrade the plasma confinement capability of SURMAC at UCLA. The upgraded device became operational in late FY 1979, and extended physics results; higher ion temperatures and lower collisionality are now being achieved routinely. In addition, activity at the University of Wisconsin to provide auxiliary heating capability for the levitated octopole is under way. Both RF and neutral beam techniques will be compared on the same device.

The only torsatron currently operating in the United States is at the University of Wisconsin. A small-scale reactor study is being supported by DOE at LASL to assess the reactor possibilities of this concept.

The Compact Toroid (CT) Program was significantly strengthened during FY 1979. The desirability of providing some definitive tests of the CT concept was recognized, and programs were initiated at LLL, PPPL, and elsewhere. The CT program is a good example of a concept with attractive reactor features and high commercial potential but which is still at an early, and therefore quite speculative, stage of development. Initial physics results on this interesting approach have been obtained and continue to support the high promise of this area.

The Compact Toroid Experiment (CTX) provides the central facility for LASL's CT program. Both ends of the cylindrical vacuum tank are available for plasma sources. Two such sources are the FRX-C device that produces a high beta plasma without a toroidal magnetic field and the Toroidal Source device that produces a plasma configuration with a toroidal magnetic field by a different technique. Each plasma configuration has different reactor potential, and the purpose of the experimental program is to resolve which approach has superior prospects. Initial operation of this facility with the Toroidal Source will occur in mid-FY 1980.

Spheromak, a compact toroid of substantial technological simplification, was reviewed during FY 1979, and a vigorous program to develop this variation of compact toroids has been initiated at PPPL. Fabrication of the S-1 device, a second generation compact toroid, has begun and will be completed by the end of FY 1981.

Fusion Plasma Theory

Fusion Plasma Theory is responsible for developing and applying physics models and mathematical techniques necessary to describe the behavior of magnetically confined plasmas under realistic operating conditions. Plasma models are developed and used to interpret results obtained in existing confinement devices and to predict performance parameters of proposed devices. Both analytical and numerical techniques are used. However, as a general rule, the more applied and device-oriented a problem is, the greater the reliance on large-scale computing. The theoretical effort is divided into four categories: tokamak theory, mirror theory, advanced concept theory, and generic fusion theory.

The tokamak, mirror, and advanced concept theory categories provide analytical support for the Tokamak Systems Experiments, Magnetic Mirror Systems Experiments, and Advanced Fusion Concepts subactivities, respectively. The generic theory category provides broadbased support for the entire magnetic fusion program. This latter category develops computer algorithms of general applicability, provides fundamental plasma physics analyses, and supplies required atomic physics data.

An Institute for Fusion Studies (IFS) is being established to serve as a center of excellence in fusion theory. The intent is to assemble many truly outstanding researchers in the field to work on the serious theoretical problems which must be solved before fusion can be a reality. The IFS will also serve as a center for international collaboration in fusion theory.

Experimental Plasma Research

The Experimental Plasma Research program supports studies that develop new techniques and provide more extensive data for the design, operation, and understanding of very large confinement experiments and commercial reactors. The program has made major contributions to the fusion effort over the years. Projects are tied to critical issues and needs of the fusion program and are largely carried out by means of small, special-purpose experiments. The subactivity has objectives in five technical areas: Plasma Properties, Plasma Heating, Diagnostics, Atomic Physics, and Advanced Superconducting Materials Research.

Impurity control methods and discharge cleaning techniques have been developed using Macrotor at UCLA. The first electron cyclotron heating experiments on a tokamak in the United States have been performed on ISX–B with a gyrotron tube developed at the Naval Research Laboratory (NRL). Far infrared technology has been developed to provide local magnetic field measurements and ion temperature measurements. Measurements and calculations of atomic properties of ions have provided the critically needed data to identify the large quantity of radiation from heavy impurities on ORMAK and PLT. Experiments on stabilizing basic drift cyclotron loss cone (DCLC) and flute instabilities in mirror devices offer hopes for simpler mirror reactor configurations. Ultraviolet and soft x-ray measurements have been introduced to many fusion confinement experiments.

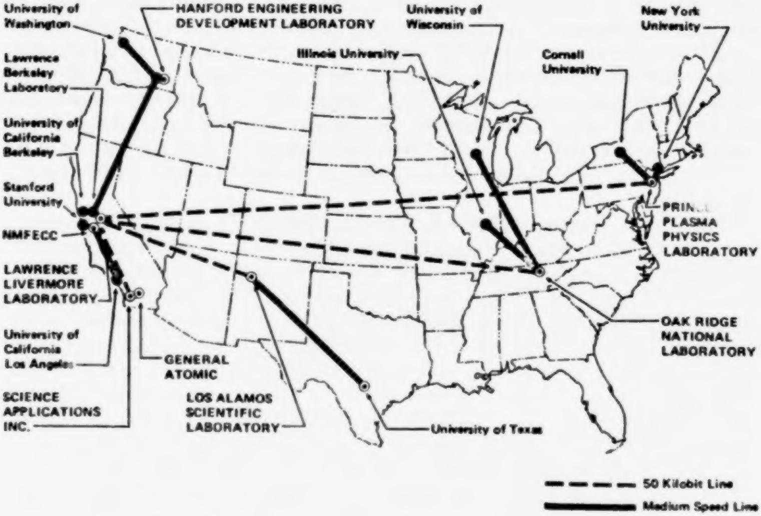
The Fusion Plasma Research Facility (FPRF) is under construction at the University of Texas to provide a national facility available to scientists throughout the nation. It will house a medium-scale fusion device (TEXT) to which users and visitors will come to perform plasma experiments and undertake diagnostic development projects. The machine will be used for critical fusion experiments requiring the dedicated operation of a reactor-grade device. TEXT has 42 large ports that make it versatile and easily used in a variety of experiments. Fabrication of FPRF began in FY 1978 and will continue through FY 1980. Initial operation is expected to be in early FY 1981. Full-scale experiments will begin in mid FY 1981.

The subactivity has made substantial contributions to the fusion program in recent years.

National Magnetic Fusion Energy (MFE) Computer Network

The National Magnetic Fusion Energy (MFE) Computer Network subactivity has two subtasks: the National MFE Computer Center and the User Service Center. The National MFE Computer Network (Figure III–42) is composed of the National MFE Computer Center (NMFECC) at LLL and five User Service Centers (at LLL, LASL, ORNL, PPPL, and General Atomic Company) which are connected to the national center by leased lines. The network was conceived to meet massive computational requirements in a highly cost-effective way, and to provide a central focus for cooperative efforts. In addition to the User Service Centers at the DOE Laboratories and General Atomic Company, more than 30 universities and other small contractors performing magnetic fusion research are connected to the NMFECC through combinations of leased lines and dial-up capability, giving them access to the large scale computing capability needed to solve certain problems. The network handles almost all of the large-scale magnetic fusion energy computing. The sharing of large codes among the various research groups has been very successful, and cooperation promises to increase in the future. The CRAY–I class VI computear added in FY 1978 has proven to be very reliable and efficient. The Cray Time Sharing System (CTSS) operating system written for this machine by NMFECC staff is now employed by other CRAY–I installations and allows users to shift codes easily between the CDC 7600 and the CRAY–I.

Fiscal Year 1981 plans include the replacement of the CDC 7600 by a class VI computer to satisfy expected computational needs. The CDC 7600 will then replace the CDC 6400, which presently handles file and data management.


University of Washington
HANFORD ENGINEERING DEVELOPMENT LABORATORY
University of Wisconsin
New York University
Illinois University
Cornell University
Lawrence Berkeley Laboratory
University of California Berkeley
Stanford University
NMFECC
PRINCETON PLASMA PHYSICS LABORATORY
LAWRENCE LIVERMORE LABORATORY
OAK RIDGE NATIONAL LABORATORY
University of California Los Angeles
GENERAL ATOMIC
SCIENCE APPLICATIONS INC.
LOS ALAMOS SCIENTIFIC LABORATORY
University of Texas
50 Kilobit Line
Medium Speed Line

Major Components of the National Magnetic Fusion Energy Computer Network

COMMITTEE ACTION

Applied Plasma Physics—No Change

(d) PLANNING AND PROJECTS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Tokamak fusion test reactor	21, 850	23, 400		0	23, 400
Inventory, spec. spares	2, 000	0		0	0
Mirror fusion test facility	9, 060	18, 100		+2, 000	20, 100
Fusion materials irradiation test facility	9, 500	7, 000		+1, 500	8, 500
Fusion engineering test facility	0	0		+6, 000	6, 000
Subtotal, operating expenses	42, 410	48, 500		+9, 500	58, 000
Capital equipment: Facility operations	4, 270	4, 400		+1, 500	5, 900
Construction:					
Authorization		130, 250		+8, 950	139, 200
Budget authority	82, 900	65, 000		+9, 200	74, 200
Total authorization		183, 150		+19, 950	203, 100
Total budget authority	129, 580	117, 900		+20, 200	138, 100

[1] Indicates changes to original fiscal year 1981 B/A request.

The Reactor Projects budget activity, managed by the Office of Fusion Energy's Division of Planning and Projects is responsible for the design and construction of large complex fusion facilities, and for providing project-specific technology development programs in direct support of such construction. The three subactivities are:

Tokamak Fusion Test Reactor (TFTR).—A major scaling experiment which will produce fusion energy at the energy break-even level, using a deuterium-tritium (DT) plasma. It will be used to study the physics of burning plasmas and the engineering aspects of D–T tokamak operation with power densities near those required for a commercial reactor.

Fusion Materials Irradiation Testing (FMIT) Facility.—A facility employing a broad spectrum, high energy neutron source required to screen and qualify candidate fusion reactor materials. The facility will be used for testing of materials. including some accelerated life testing, and for providing information for development of alloys less likely to become radioactive or damaged due to the neutron bombardment.

Mirror Fusion Test Facility (MFTF–B).—The original facility will be rescoped to a large tandem mirror experiment using the original MFTF as one end cell.

Fusion Engineering Test Facility (FETF).—New Project in FY–81 which provides required technology focus for entire MFE program. This facility is to be completed by end of FY–1987. TEC to be set after Title I engineering.

Tokamak Fusion Reactor (TFTR)

TFTR is a major scaling experiment which will produce fusion energy at the energy breakeven level, using a D–T plasma. It will be used to study the physics of burning plasmas and the engineering aspects of D–T tokamak operations with power densities near those required for a commercial reactor. It will be the first fusion device to explore the engineering requirements of remote maintenance, since the use of tritium will lead to low-level contamination of some device components.

TFTR will be the largest U.S. tokamak device with a major radius (distance from the axis of the torus to the center of the toroidal ring) of 2.65 meters and a radius for the vacuum vessel (torus cross-section) of 1.1 meters. Under optimum experimental conditions a high-power neutral deuterium beam (20 MW) will be injected into a warm tritium plasma. The Lawson Product for the resulting plasma is estimated to be between 10^{13} and 10^{14} cm–$^{-3}$–sec, bordering on the required for plasma ignition. TFTR will be a pulsed device (like all tokamaks) with one pulse every 5 minutes. It will have an extensive diagnostic system so that every important plasma property can be carefully monitored and the relationships between properties investigated.

Status

Preliminary design work on TFTR began in February 1976 and groundbreaking ceremonies took place in October 1977. All the major design issues have been resolved and most of the key procurement contracts have been placed including the vacuum vessel, toroidal field magnet coils, and neutral beam and magnet power supplies. Total construction cost for TFTR is estimated at $284M. The facility is scheduled for completion by June 1982.

Of the many challenging design problems in TFTR, two of the more difficult were the toroidal field coils and the neutral beam injection system. High-stress levels in the first coil design led to a large redesign effort which succeeded in solving the problems. The neutral beam system is now operational at Lawrence Berkeley Laboratory. Full beam performance has been achieved. Construction of the TFTR facilities is about half complete. Some hardware such as the large motor generator sets is now being installed.

Fusion Materials Irradiation Testing Facility (FMIT)

The FMIT facility will use a broad spectrum, high energy neutron source. Both the maximum neutron flux and the test volume are greater than with HINS. The FMIT facility will provide the peak neutron flux, the test volume, and the neutron spectrum representative of fusion reactor conditions. FMIT is needed to screen and qualify candidate fusion reactor materials. The facility will be used for testing of materials, including some accelerated life testing, and for providing information for development of alloys less likely to become radioactive or damaged due to the neutron bombardment.

The neutrons for FMIT are produced by a lithium-deuterium stripping reaction. A deuteron (the nucleus of deuterium) beam is accelerated and aimed into a flowing stream of liquid lithium which is maintained at a temperature of about 220°C. The proton stripped from each deuteron (which consists of a proton and a neutron) is attracted to the lithium. The remaining neutrons emerge with a broad energy spectrum. The energy peak of the emerging neutrons can be adjusted by changing the energy of the incoming deuteron beam. Tritium will be produced in the reaction and provisions for handling it are included in the FMIT facility. Heat exchangers are provided to cool the lithium.

Status

Preliminary design began in 1979 and ground breaking ceremonies took place in February 1980. Total construction cost for FMIT is $105M. The facility is scheduled for completion by October 1984.

Tandem Mirror Fusion Test Facility (MFTF–B)

MFTF–B will be a major step in exploring tandem mirror characteristics under reactor-grade plasma conditions. The principal purpose of the original MFTF task is to provide a large-scale magnetic mirror device and supporting facility for performing physics experiments and technology development needed to bridge the gap between smaller existing mirror experiments (such as Beta II) and a mirror fusion ETF.

MFTF–B will bring together the main technical elements which may be required by a mirror ETF: superconducting magnets, high-powered neutral beams, high vacuum pumping systems, and quasi-steady state operation. It will provide the opportunity for establishing the viability of the economically important tandem concept and the testing of proposed solutions to the problems of end-cell operation in a large tandem mirror. Since the tandem mirror concept has proved feasible, MFTF has been upgraded to MFTF–B and used to perform experiments on a scaled-up version of the tandem mirror device. MFTF will still provide a test of critical engineering systems while MFTF–B is in construction.

Status

The MFTF facility was proposed by LLL in 1976. It received favorable comments from several technical review groups and was authorized for construction at the beginning of FY 1978 at an estimated cost of $94.2M. During FY 1977, a management team for MFTF and a project office at Livermore were established. Construction of the magnet coil winder was completed in December 1977, and the practice coil winding was initiated in 1978. Winding of the production Yin-Yang magnet is almost complete and the large fusion chamber is now erected.

The total construction time will be about 70 months, with final system checkout and initiation of plasma experiments planned for late 1984. Initially this test device will be used for the development of prototype systems, and for the testing and evaluation of plasma-streaming gun, neutral beam systems and other technical components.

COMMITTEE ACTION

Planning and Projects—$19.95 million increase

A $6.0 million increase was authorized for conceptual design work for the Fusion Engineering Test Facility (FETF). In addition, the

Committee approved authorization of $7 million for preliminary Title I engineering, site evaluation and site selection for the FETF (81–MF–1). This particular project is vital to provide the needed focus for the engineering technology development, as well as plasma physics, for the entire magnetic fusion energy program.

A $2.0 million increase in operating funds was approved to rescope the Mirror Fusion Test Facility (MFTF) into a tandem mirror experiment (MFTF–B). An additional $30 million authorization was approved for the MFTF construction project (78–3–a) to begin performing the needed modifications and additions. Any reduction below this level significantly increases total estimated cost and stretches out the completion date.

A $1.5 million increase in operating funds, and $1.5 million increase in capital equipment was approved for the Fusion Material Irradiation Test Facility. This project is in a critical funding situation and the Committee added these funds to keep the project on schedule, and avoid higher costs in future years. Authorization for FMIT was reduced by $22.25 million in accordance with the Committee's policy to limit construction to two years.

A $1 million decrease in General Plant Projects was approved. This will affect some of the proposed construction at Oak Ridge National Laboratory (ORNL) and Princeton Plasma Physics Laboratory (PPPL).

$0.2 million was added to renovate an existing building at the Massachusetts Institute of Technology (81–MF–3). This building is needed for program expansion of the Fusion Research Center which performs the Alcator-C high magnetic field experiments.

Authorization for the Tokamak Fusion Test Reactor was decreased $5 million because the Committee believes that a $10 million contingency for FY 1982 may not be necessary.

2. INERTIAL CONFINEMENT FUSION (CIVILIAN APPLICATIONS)

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate [1]	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [2]	Committee action	
				Changes to original authorization request	Total authorization
OPERATING EXPENSES					
Heavy ion beam fusion	4,500	11,300	....	−4,800	6,500
CAPITAL EQUIPMENT					
Facility operation		4,000	....	−3,000	1,000
Total	4,500	15,300	....	−7,800	7,500

[1] Authorized by House Armed Services Committee.

[2] Indicates changes to original fiscal year 1981 B/A requests.

Program description

Inertial confinement fusion (ICF) concepts being investigated by DOE laboratories, private industry, and universities include laser, electron beam, and ion-beam fusion. All of these approaches are based on the concept of a spherical fuel pellet being imploded to produce compressed fuel at densities approximately 1,000 times that of normal liquids. This process of implosion and compression results in heating of the fuel to the temperatures required for energy gain.

Following ignition the reactions in the pellets will release energy for a few billionths of a second. The energy is in the form of high velocity atomic particles and X-rays which can be converted to useful heat by absorption in the walls of a surrounding chamber.

The heat can be used to produce steam for generating electricity or for direct application in chemical processes. It may also be possible to use some of the fusion particles directly to stimulate chemical reactions.

All of the inertial confinement fusion approaches require the development of powerful laser, electron-beam, or ion-beam sources capable of producing intense energy pulses in the form of light or energetic particles. In order to ignite the fuel it is necessary to focus the output energy of these devices onto pellets on the order of a millimeter in size. If the energy from the laser or particle source is deposited rapidly enough, the inertia of the fuel pellet will hold it together sufficiently long to permit the reactions to occur.

COMMITTEE PERSPECTIVE

Of the presently available drivers for ICF, the Heavy Ion Beams are the newest to be explored, and appear to have potential commercial applicability. In order to assess the real capability of this type of driver for civilian applications, funding must be provided to (1) test possible ion accelerator schemes, (2) assess target chamber physics requirements, and (3) perform conceptual systems design studies. The House Armed Services Committee indicated their intention to not fund Heavy Ions starting with the fiscal year 1981 budget. Since this system appears to have mostly commercial applicability and little military value, the Committee believes that this activity should be funded as a civilian energy R&D program.

COMMITTEE ACTION

Inertial Confinement Fusion (Civilian Applications)—$7.5 million Increase

$7.5 million authorization for Heavy Ion Beam development was approved by the Committee in response to the Armed Services Committee reductions in its review of military applications of Inertial Confinement Fusion (ICF) research. Heavy ions may have the most long term commercial potential for energy production of any of the ICF drivers. Half of the funding would go for developing one of the two basic accelerator approaches into a scaled-up test facility. The remainder would be divided between smaller scale simulation experiments, critical accelerator development, and supporting theory/systems studies.

C. Fossil Energy—Research and Development

1. COAL

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
OPERATING EXPENSES					
Mining research and development	56,000	34,000		+7,000	41,000
Coal preparation R. & D.	12,650	11,000		−1,000	10,000
Coal liquefaction	170,006	158,200		+3,000	161,200
Surface coal gasification	100,350	83,000	−10,000	−8,000	75,000
In situ coal gasification	9,900	9,900	−5,000		9,900
Advanced research and technology development	47,500	53,261		+3,000	56,261
Advanced environmental control technology	37,450	42,000		−5,000	37,000
Heat engines and heat recovery	50,300	43,400	−7,000	+2,500	45,900
Combustion systems	50,850	49,065	−3,000	−18,500	30,565
Fuel cells	26,000	25,000	−5,000	+12,000	37,000
Magnetohydrodynamics	75,000	71,500	−1,000		71,500
Subtotal, operating expenses	636,006	580,326	−31,000	−5,000	575,326
Program direction	11,387	12,145			12,145
Subtotal	647,393	592,471	−31,000	−5,000	587,471
CAPITAL EQUIPMENT					
Mining research and development	200	1,500			1,500
Coal preparation R. & D.	0	0			0
Coal liquefaction	300	700			700
Surface coal gasification	500	500			500
In situ coal gasification	100	100			100
Advanced research and technology development	400	500			500
Advanced environmental control technology	800	500			500
Heat engines and heat recovery	200	0			0
Combustion systems	0	300			300
Fuel cells	500	0			0
Magnetohydrodynamics	0	500			500
Subtotal	3,000	4,600			4,600
CONSTRUCTION					
Authorization	103,250	633,435	−4,000	−257,835	375,600
Budget authority	103,250	449,835	−4,000	−74,235	375,600
Total authorization	753,643	1,230,506	−35,000	−262,835	967,671
Total budget authority	753,643	1,046,906	−35,000	−79,235	967,671

[1] Indicates changes to original fiscal year 1981 B/A request.

(a) Coal Mining Research and Development

Program Description

The coal mining R&D program was part of the Department of Interior's Bureau of Mines until the Department of Energy was created. Additional mining R&D responsibilities were given to the Department in Public Law 95–87, the Surface Mining Control and Reclamation Act of 1977. The Bureau of Mines program concentrated on research and development to improve mining productivity while P.L. 95–87 sought to strengthen the environmental aspects of the program. The mining program includes research and development for both underground and surface coal mining.

The coal mining requests for fiscal years 1980 and 1981, when compared to prior years were greatly reduced. The President's 1981 request is about one-half the 1979 appropriations level. The documentation accompanying the Fiscal Year 1980 request justified that year's cuts as a slow down which would allow review of priorities and stretch-out the mining R&D program. The FY 1981 budget documents justify the further cuts as elimination of low priority projects and a pause to permit a multi-agency government-wide review of mining research and development in Fiscal Year 1980.

UNDERGROUND COAL MINING

The underground coal mining sub-activity is directed towards research and development to improve mine planning and development; production; and transport of men, materials and coal. The request in this area is slightly less than half of the 1979 appropriation level.

Mine planning and development is a major activity within the Department's underground coal mining program. A strategy is exercised here which if properly implemented will reduce costs, minimize environmental degradation, and assure the health and safety of miners by identifying potential hazards and mitigating them before the mine is opened. Work will continue in FY 1981 on development of a technological data base on the major health, safety and environmental concerns such as the prediction and control of gases and fluids entering the mines, ground subsidence, disposal of mine waste, and control of mine effluents. The speed of mine development is the other major concern in mine planning and development. Traditionally, this item has included a variety of projects designed to increase conventional mining production. Large mechanized boring machines that can sink mine shafts ten times as fast as the traditional drill-blast-muck cycle have been a major item under this heading. Each of the major projects though have been stretched out to the point where FY 1981 goals are not much different than the goals presented in the FY 1980 budget.

Improvement of the prevalent room and pillar mine production technique and of panel mining have traditionally been the largest budget activity under underground coal mining. The primary problem addressed in room and pillar mining continues to be that of increasing the efficiency of continuous mining machinery by adding additional components and improving support systems. Underground trials of a monorail bridge conveyor and automated bridge conveyor train are scheduled to begin in FY 1980 eventually leading to the design of advanced continuous miner-bolters.

In the panel or long-wall mining area, the main issue is how to broaden use beyond 5 percent since this technology offers the potential for increased productivity, worker safety, and decreased environmental impacts, especially when shallow deposits are exhausted and mining moves deeper underground. Surface trials of a prototype long-wall shearer control subsystem necessary for mining automation will be completed. Work towards development of fully integrated guidance and control systems for long-wall automation will proceed as will efforts to develop a fully integrated system for thin seams.

The final major component of the underground mining program is the subprogram dealing with transport and other support activities. Economic transportation of coal to the surface at a rate commensurate with coal production is essential for efficient mine operation. This portion of the budget, which is down dramatically from former years, will support an underground demonstration of a production prototype for an automated rail haulage system in FY 1981. There is also a study and support function in the underground coal mining program which includes operation of the surface test facility in Pittsburgh and engineering services, studies, and seminars concerning advanced technologies.

SURFACE COAL MINING

Coal production from surface mines has increased steadily over the past decade. In comparison to underground mining, surface mining has the advantages of lower production costs, a generally higher resource recovery rate, and less health and safety problems. The economics of surface mining, however, are very sensitive to the ratio of overburden thickness to seam thickness and as practiced in the past, surface mining has had serious negative environmental impacts. Three types of problems being addressed in surface mining are the development of new surface mining equipment that will meet environmental regulations at the lowest possible cost, the need for the development of better mining systems to extend the capabilities of surface mining, and the need for a new technology which by design increases environmental and worker protection and improves efficiency. There is considerable stretch-out in the surface coal mining program.

The surface coal mining program focuses on area mining for the West and contour mining for the East. In FY 1981 designs of highly mechanized, continuous evacuation systems will be developed for handling the large volumes of overburden typically found in the Western coal regions. This work was originally scheduled to be completed in FY 1980. Also, in FY 1981 the trial of a low-wall conveyor haulage system developed for extraction of coal in steep-slope areas of Appalachia will be completed. Surface coal mining support activities that will continue through FY 1981 include research in conventional mining equipment such as drag lines, front-end loaders, and specialized reclamation machinery.

Committee action

The Committee increased operating funds by $7 million, and again this year has separated the coal preparation activities into its own line. The Committee observes that the only thing coal mining and coal preparation have in common is their place in the front end of the coal fuel cycle.

The Committee's coal mining research and development additions were $2 million for an open pit mining demonstration program in the anthracite fields, $2 million for advanced longwall mining technology, and $3 million for underground haulage systems. Even with these additions the two programs will be moving forward at a reduced level when compared to FY 1979 and FY 1980.

The anthracite open pit mining demonstration project for which $2 million is added will support a feasibility study for open pit mining in the anthracite fields, as well as some advanced engineering work. Anthracite mining is currently done by a number of small companies who operate small mines with steeply sloping seams. The productivity trend in anthracite mining is generally downward because these small companies cannot afford the major research and development effort that is required to develop new large-scale operations. In determining the feasibility of such a demonstration, the Department also is expected to encourage state, local, and private participation.

The $2 million increase in funding for advanced longwall mining technology reflects the Committee's concern that major cuts in this sub-program could substantially delay wider acceptance of this important underground mining technology. Ninety-five percent of the coal removed through underground mining is mined with the room-and-pillar method. This technology relies upon huge pillars of coal for mine support, and therefore is not a very efficient method of coal recovery. Longwall mining offers potential for increased coal production and productivity as well as improved health and safety in underground mining. This technology relies on the slicing of long, rectangular blocks of coal and permitting the roof to crumble as the mining operation advances. While this technology has been in use in Europe for some time, the Department of Energy's program offers great promise in increasing system efficiency.

$3 million has been added for further development of underground haulage systems. The Committee feels that the level of OMB's cuts in this area was a mistake in light of the decline in underground mining productivity throughout the '70's. Underground haulage systems are perhaps the most obvious area for increasing mining efficiency since inability to remove materials from the mine continuously permits the expensive "continuous" mining machines to be used only a small portion of the time.

(b) COAL PREPARATION AND ANALYSIS

Program Description

Coal preparation involves a variety of techniques for preparing raw mine-mouth coal for use in boilers, coking ovens, and industrial processes by removal of impurities such as ash, sulfur and trace elements. Modern mining techniques have increased the amount of impurities in mine-mouth coal and as a result most coal mines use some form of physical coal preparation. The major objective of the coal preparation program in the Department of Energy is to develop new and improved coal preparation technology. The Department's program for developing a data base on coal's physical and chemical characteristics is also included here.

Physical coal preparation is the process of crushing, sizing, cleaning, and upgrading coals on the basis of their physical properties, including specific gravity. Traditionally physical coal preparation has been used to improve the thermal value of coal at minimal cost. Now it is increasingly being used to remove pyritic sulfur from coal.

Even though physical coal cleaning can remove only pyritic sulfur and none of the organic sulfur contained in coal, it is almost always cheaper in a coal combustion system to remove sulfur through a combination of physical coal cleaning and stack gas cleanup, than by relying on stack gas cleanup alone. Since the technology is fairly well developed for coarse coal cleaning, DOE's program is geared toward upgrading coal finer than one-half inch. In FY 1981 work will continue on wet and dry, high gradient magnetic separation which uses the weak magnetic property of pyritic particles to separate them from coal and other separation techniques. There also will be a major effort to assess the benefits of using clean coal for steam raising. This work will be cost shared by TVA.

Chemical coal cleaning is a term used to describe a variety of longer term, higher risk technologies which chemically remove some of the organic sulfur contained in coal. Unlike physical cleaning which has coal as the end product, chemical cleaning produces a product whose physical and chemical properties are modified by chemical reaction. There are presently no commercial chemical coal cleaning techniques and much remains to be done before any of these technologies will be economical. Although a wide variety of techniques ranging from chlorinolysis to microwave radiation will continue to be researched during FY 1981. The oxydesulfurization approach is the one the Department is pushing the hardest. If the results are positive from an FY 1980 study evaluating 3 major alternative processes and oxydesulfurization shows commercial potential, the program will be geared toward making technology commercial within 7 to 8 years.

Committee Action

The Committee reduced the Coal Preparation program by $1 million. The entire reduction is expected to be taken in the chemical coal cleaning area. The Committee recognizes the importance of coal preparation technology in supplying relatively sulfur-free coal to coal-fired power plants. It wishes to emphasize the importance of continuing research into beneficial redistribution of coal macerals (fragments of plant debris in the coal) with special attention to the potential uses of the low grade byproduct when a high-quality coal is made from maceral redistribution.

The Committee, however, is less sanguine about the future of chemical coal cleaning and tends to view it as a technology whose time will have passed before it is commercially available. The Committee notes that several of the emerging coal combustion technologies, such as atmospheric and pressurized fluidized bed boilers, will be able to use run-of-mine coal and therefore will not need physical cleaning, let alone chemical coal cleaning. Furthermore, chemical coal cleaning technologies face a long development period and it is likely that physical coal cleaning and advanced flue gas desulfurization units will be available for those existing power plants which are not replaced by fluidized beds or other advanced technologies.

(c) COAL LIQUEFACTION

Program description

The goal of the coal liquefaction program is to facilitate the establishment of an environmentally acceptable synthetic liquid fuel industry. Specific objectives are to:

1. Demonstrate the technical capability of commercially producing clean liquid and solid fuels from coal by at least four direct liquefaction processes. SRC–I, SRC–II, H–Coal, Exxon Donor Solvent (EDS) by the late 1980's.
2. Develop improved indirect liquefaction processes to produce liquid fuels from coal by the late 1980's.
3. Promote the development of more advanced third generation coal liquefaction processes which can be demonstrated to be commercially viable in the 1990–2000 time frame.

Major subactivities in the coal liquefaction area include research, process development and process evaluation in the categories of direct hydrogenation, solvent/extraction, third generation processes, and indirect liquefaction. The major milestones of FY 1981 budget request are continuation of construction of the SRC–1 and SRC–II Demonstration Projects, and operation of the H–Coal and EDS pilot plants.

(1) The SRC Demonstration plants: SRC–I Owensboro, Kentucky, project (78–2–d); SRC–II Morgantown, West Virginia, project (79–1–r).

The Solvent Refined Coal (SRC) Demonstration Program was initiated in July 1978 with the award of multiphased contracts to the Southern Company Services Inc. for demonstration of the solid SRC (SRC–I) process and to the Gulf Oil Corporation for demonstration of the liquid SRC (SRC–II) process. The plants are being designed as 6,000 ton per day full scale "first modules" of multi-module commercial plants to be completed by the sponsoring industrial partners. Research into the SRC technology has been underway since the early 1960's; pilot plants at Ft. Lewis, Washington and at Wilsonville, Alabama have succeeded in making solid and liquid fuels. Both contractors completed Phase Zero preliminary design studies in mid 1979. In Phase Zero, the contractors prepared preliminary demonstration plant designs and cost estimates, long lead procurement plans, market and economic assessments, detailed management plans for subsequent phases, cost sharing proposals and environmental analyses for their projects. As a result of the Phase Zero studies and subsequent evaluations by the DOE project managers at headquarters and the Oak Ridge Operations Office, Oak Ridge, Tennessee, have completed the most recent budget estimates. The following table summarizes the increases.

SRC DEMONSTRATION PROJECT COSTS

[In millions of dollars]

	SRC I			SRC II		
	1977 Southern companies estimates	December 1979 DOE estimates	Change	1977 Gulf estimate	October 1979 DOE estimates	Change
Phase I design	$30	$129	$99	$40	$134	$94
Phase II (construction)	554	1, 113	549	545	981	436
Phase III (startup and commissioning)	100	126	26	100	193	93
Project total	$684	$1, 358	$674	$685	$1, 308	$623

Major increases in the construction phase for both projects come from using a larger escalation rate (9.5 percent instead of 6 percent) and larger allowances for contingency.

The FY 1981 budget authority request for SRC–I is $5 million in operating expenses and $175 million in construction funds. The requested FY 1981 operating expenses will be employed for project management and contract administration, evaluation of long-range marketability of SRC and byproducts and obtaining agreements for the purchase of coal feedstocks and raw materials. The request for construction funds will provide for the completion of detailed design, major equipment procurement, and for the continuation of plant construction.

The FY 1981 budget authority request for SRC–II is $5 million in operating expenses and $190 million in construction funds. The requested FY 1981 operating expenses will be utilized for contract administration, completing markets evaluation for plant products, evaluation of long-range marketability of synthetic liquids, obtaining agreements for purchase of plant products; and obtaining contracts for the purchase of coal feedstocks and other requirements. The FY 1981 request for construction funds will be for the continuation of the detailed design, initiation of major equipment procurement, and continued construction.

In addition $28 million in operating expenses is requested for technical support for the demonstration projects by operation of the pilot plants in Takoma, Washington and Wilsonville, Alabama and the PDU at Harmerville, Pennsylvania. Tests will be made on additional coals and environmental and biomedical programs will be carried out at both pilot plants.

The size of this request ($403 million) will be dwarfed by the requirements for FY 1982 (more than $1 billion). Negotiations are under way with Germany and Japan to cost-share up to 50 percent of the SRC–II project costs; there are no such prospects for cost-sharing the SRC–I project. Further, current estimates of industrial participation appear to be on the order of $100 million for each project (i.e., less than 10 percent). Thus, these projects will be a heavy mortgage on DOE and particularly the Fossil program for the next 4–6 years.

(2) The Exxon Donor Solvent Pilot Plant, Baytown, Texas. The Exxon Donor Solvent (EDS) process is a noncatalytic process that liquefies coal by the use of a hydrogen donor solvent obtained from coal-derived distillate. The donor solvent transfers hydrogen to the coal, thus promoting liquefaction of the coal. The process is less com-

plex than SRC and utilizes engineering and design technology similar to that practiced in the petroleum industry. Solid-liquid separation is achieved through distillation. It is sufficiently flexible to allow for different varieties of coal feed and produces a wide spectrum of liquid products depending on market demand.

The heavy bottoms from distillation in theory either can be sent to a flexicoker to produce additional liquids and low-Btu gas for in-plant fuel use or to a gasifier. Hydrogen for in-plant use is provided by steam reforming of gases produced in the processes. The hydrogen is recycled to the liquefaction and solvent hydrogenation sections. Exxon Research and Engineering initiated EDS research in 1966 and continued through 1975 on predevelopment planning and design phases which resulted in a ½ ton/day demonstration. In 1975, Exxon (and other industrial partners) entered into a cooperative agreement with ERDA (now DOE) to cost-share on a 50/50 basis continued development of the process in a pilot plant to be constructed at its Baytown, Texas site. Under the agreement, Exxon will manage the program, hold title to the patents, and actively attempt to license the process. DOE shares in the royalties of any commercial venture. Construction of the project will be completed in FY 1980 and operation using Illinois No. 6 coal will begin. In FY 1980, the scope of the project was extended to permit modification and operation of a prototype flexicoker on the Baytown site. Currently other gasifier options are being considered for the critical bottoms-processing step. The funding level requested for FY 1981 will permit testing a limited range of additional coal feedstocks at bench scale. The increase over FY 1980 is to complete bottoms processing studies and to evaluate various coals in the EDS process.

(3) The H-Coal Pilot Plant, Catlettsburg, Kentucky.

The H-Coal process is a catalytic hydroliquefaction process that converts high sulfur coal to either a boiler fuel, that will meet sulfur emission regulations, or a refinery syncrude. The specific conditions of the H-coal process affect the type of fuel produced. To produce refinery syncrude, for example, more hydrogen is required and there is low yield of the heavier product. To produce a clean fuel and liquid low-sulfur boiler fuel, the flow through the reactor is increased and less hydrogen is required. If synthetic crude oil is desired, separation of the solids from the liquid products can be accomplished by a distillation process.

This project experienced serious schedule delays and cost overruns. In FY 1980, DOE amended its original budget of $35 million for the project to $64.5 million to keep the project on schedule. Construction of the project will be completed in FY 1980. Funding of this project at the requested level of $57,000,000 will support operation of the H-Coal plant in two modes of operation in FY 1981 to produce either syncrude or heavy fuel oil. Successful operation will accelerate commercial development of this technology by providing data for the design of a commercial facility. PDU and laboratory support efforts will continue.

(4) Indirect Liquefaction. Until the recent interest of the past year in the immediate production of synthetic liquids from coal using current indirect liquefaction technology, the fossil energy program emphasized the advanced direct liquefaction technologies. It has sup-

ported a number of indirect liquefaction projects at low levels in the budget line for Advanced Research and Technology Development and Third Generation Processes.

Indirect liquefaction technologies produce liquids in two steps: (1) coal is gasified to hydrogen and carbon monoxide; (2) the hydrogen and carbon monoxide are reacted in the presence of a catalyst to form a liquid. The specific mix of liquids depends on the catalyst, the pressure, temperature and residence time in the reactor.

In order to achieve a substantial improvement over existing indirect liquefaction methods, new technology will be developed that integrates efficiently with second-generation coal gasification systems. Existing technology requires hydrogen-rich feed gas and results in a low thermal efficiency. Catalysts and reactor systems that allow the direct use of the clean synthesis gas will be evaluated at bench scale and the most promising candidates tested at pilot scale. Three candidate fuels, methanol, full grade alcohol, and hydrocarbons such as gasoline could be produced.

The preferred route would be via the hydrocarbons since this requires the lowest hydrogen content in the synthesis gas per Btu of fuel produced. However, the technology for the alcohols route is further developed and will also be evaluated. This program is being expanded in FY 1981 in order to complement the development of second-generation coal gasifiers in the mid to late 1980s.

A limitation of existing technology is the inability to produce a quality product in a selective fashion. The use of modern zeolite-based catalysts provides a potential solution to this problem. This effort will build on the pioneering work done under prior DOE funding. Data will also be obtained on the ability of zeolite catalysts to upgrade Fischer-Tropsch liquids in a simple, efficient process to high-octane gasoline.

Prior to FY 1980, a major laboratory-based effort was carried out with Mobil Oil Company to develop the M-Gasoline process (conversion of methanol to gasoline).

In FY 1980 it is expected that at least five new industrial R&D contracts will be started. Also smaller scale projects at Oak Ridge and Brookhaven and various universities, will be initiated on reaction mechanisms and catalyst surface properties. It is expected that two pilot plant projects will be initiated in FY 1980: a 100 bbl/day fluid-bed methanol-to-gasoline unit utilizing the Mobil process in conjunction with the Federal Republic of Germany, and a 35 bbl/day liquid phase/slurry phase syngas-to-methanol pilot plant.

The current FY 1981 budget request has no funds for these activities; however, the budget justification materials indicate that a $28 million program will be pursued with expected revenues from the windfall profit tax. These funds will be required to continue projects begun in FY 1980.

Committee views

Since the first session of the 96th Congress, legislation has been under consideration which would establish and provide initial subsidies for a national synthetic fuels production program. An aggressive production program would depend first on deployment of currently available technologies such as indirect liquefaction of coal, surface retorting of oil shale, and fermentation of grain to ethanol. However, establishing an unsubsidized, environmentally acceptable, large scale private synthetic fuels industry will depend in part on the development of new technologies. Thus, a successful DOE demonstration program will be critical to achieving a competitive synthetic fuels industry.

Anticipating the role that the DOE demonstration program would have within a national commitment to synthetic fuels production, the Committee assembled an Advisory Panel on Synthetic Fuels to review and make recommendations on the DOE synthetic fuels program. Noting the traditional management problems experienced in the past with large fossil energy projects, the Panel, nonetheless, urged rapid commitment to and construction of the current DOE liquefaction and gasification demonstration projects. The Panel felt strongly that successful execution of both the DOE demonstration program and a production program would require that the private participants in these projects have management control and responsibility and have substantial upfront financial involvement at risk. This would ensure that DOE has the private sector's best economic and technical judgment as well as recognizing that it is only industry that has managerial expertise to execute the large projects required by the demonstration and production programs.

The Advisory Panel also noted the consequences of the gasification demonstration projects for liquefaction technology. Advanced gasifiers are needed in both indirect and direct processes. They are the first step in indirect plants and the gasification of "bottoms" from direct processes will make or break the economics of direct liquefaction plants.

With these comments in mind, the Committee is concerned about the small percentage of private financial involvement in the SRC demonstration projects. The size of these projects, the mortgage they represent for the program in future years, and their importance beyond the demonstration program absolutely require that their construction be managed impeccably with respect to costs and schedules. The Committee will exercise explicit and detailed oversight on these projects since it is not convinced that currently proposed cost-sharing arrangements are adequate to guarantee effective execution of the projects.

The Committee is also aware of the negotiations under way to provide Texaco gasifiers for the "bottoms" processing step in both projects. The Committee understands that the Texaco gasifier is one of the most promising of the advanced gasifiers and that previous DOE efforts to demonstrate the gasifier have not materialized. The opportunity to combine a commercial scale demonstration of both SRC technology and the Texaco gasifier should be aggressively pursued. Questions about the proven nature of the gasifier's operation on "bottoms" material should not delay negotiations with Texaco for the SRC projects.

Committee action

The Committee added $3 million for technology development of reliable critical components, redirected $5 million in operating expenses for indirect liquefaction and decreased the construction funds authorization request for the SRC I and SRC II projects by a total of $95 million.

The Committee increased the technology development activity under liquefaction by $3 million. The Committee recognizes that large synfuels demonstration projects and production plants will push the performance limits of components like pumps, valves, heat exchangers and oxygen compressors. Failure analysis, long duration performance testing and instrumentation development should be done as a collateral activity with the procurement and construction of the large synthetic fuels demonstration plants. The Committee's increase supports this kind of activity.

The President's FY 1981 DOE budget request contained no funds for indirect liquefaction activities. However, the budget indicated that $28 million would be requested for indirect liquefaction technology development after the windfall profits tax was enacted. It is not clear when the President will submit his request for these funds. Given the current budget constraints, the Committee wishes to make clear its intentions about pursuing indirect liquefaction whether or not additional requests are made. Thus, it has redirected up to $5 million for indirect liquefaction activities. Under this funding, the Committee wishes to cover the operation of the Mobil methanol-to-gasoline process pilot plant in Germany and the liquid-phase slurry process. The Committee feels that these are the highest priority activities in this area.

The other action concerns the construction authorization requests for the SRC I Demonstration project and the SRC II Demonstration project. The Committee has reduced authorization for the SRC I project by $45 million. The Committee has reduced the SRC II demonstration project authorization request by $50 million.

The Committee's prior experience with the Department of Energy's record of committing funds and managing large projects leads it to believe that the FY 1981 request for the SRC I and SRC II projects is well in excess of what actually will be needed in FY '81. Testimony from Gulf, the SRC II contractor, indicates that they need $30 million less in budget authority than the Department has requested.

The Committee's Advisory Panel on Synthetic Fuels stressed in their report the importance of significant private financial participation in demonstration projects from an early stage of development. The Committee is concerned about the small percentage of cost sharing in the SRC demonstration projects and the possibility that the Gasification Demonstration Projects will be minimally cost-shared. Having these projects constructed on time and within cost requires full utilization of the private partners' expertise in mobilizing manpower and material for these large construction projects. However, if the private partner has little at risk, the Committee is concerned about (1) the commitment to delivering these projects; (2) the lack of incentive to avoid cost overruns; and (3) the degree of commitment to commercializing the technology once the demonstration plant is built. In addition to the traditional contract cost sharing approach, possible means of resolving these uncertainties could include overrun cost sharing, process and/or patent exclusive rights, and facility and/or plant purchase. In order to stimulate thinking in the Department on these issues, the Committee has added language to the bill which would require a report within 90 days of enactment of the bill to deal with the Department's policy and position on these items for both demonstration and pilot plant design, construction and operation.

(d) SURFACE COAL GASIFICATION

Program description

The general objective of this program is to develop and demonstrate the advanced technology needed to promote the economic and environmentally acceptable manufacture of fuel gas from coal having a heating value between 150 and 1000 Btus. The current program organization has three major components: (1) high Btu gasification for clean pipeline quality gas, (2) low/medium-Btu gasification for clean industrial and utility fuel gas and (3) third generation gasification for advancing the state-of-the-art of both high- and low/medium Btu technologies. The efforts are supported by special projects, studies and demonstration projects. Each of the subcategories is organized with its own goals and objectives.

1. HIGH BTU GASIFICATION

The objectives of the High-Btu Gasification program are:

1. Evaluate the technological and economic status of existing first-generation processes and assess their suitability for meeting the U.S. market needs; (2) promote the development and demonstration of new and improved second-generation technology for commercial-scale plants to convert domestic coals (caking as well as noncaking) to synthetic natural gas of pipeline quality; (3) continue the development of third-generation high Btu gasification processes; (4) promote commercial-scale implementation of the demonstration plant program for high-Btu gasification.

In the past this budget category supported a number of second generation processes at the pilot plant level. These included Bi-gas, the CO_2 Acceptor process, HY–Gas, the British Gas/Lurgi Slagger and the CoGas process. The last three are now developed sufficiently for consideration as demonstration projects. The CO_2 Acceptor process has been fully evaluated and shelved due to marginal economic performance.

The Bi-Gas pilot plant has been renovated after a fire in 1978 and will operate during FY 1980 and 1981. The pilot plant has a fully integrated downstream gas cleanup system, which can provide information of general application for gasification systems.

The other major activity is peat gasification, which includes the general activities of resource assessment, dewatering and environmental assessments. In FY 1981, gasification of peat may be tested at pilot plant level depending on the results of preliminary assessments in the other areas.

2. LOW/MEDIUM BTU GASIFICATION

The objectives of the low-Btu coal gasification program are to: (1) promote the development and demonstration of improved gasification technologies for commercial-scale plants to convert coal to environmentally acceptable gaseous fuels for use in electricity generation, as an industrial fuel, and as a chemical feedstock; (2) ensure that technological advances in low-Btu gasification are made available to users of existing commercial gasification systems and provide operating data sufficient to establish the confidence level necessary for other potential industries and utilities to use this technology; (3) acquire a commercial experience base in specific applications or industries to eliminate uncertainties such as capital and operating costs, retrofit problems and the effect of using gas from coal on the end product; (4) establish the availability, through development and/or demonstration, of cleanup equipment and systems suitable for use with low-Btu gasifiers in satisfying current as well as projected environmental requirements.

The FY 1981 request from DOE contains funding for the following major activities:

(a) Fixed bed gasification—These activities involve a stirred-fixed bed gasifier at the Morgantown Energy Technology Center and a slagging gasifier at the Grand Forks Energy Technology Center. The major emphasis in these facilities focuses on downstream gas clean up and environmental evaluations of gas and liquid effluents. These will be important data to have prior to the operation of first generation synthetic fuel production plants.

(b) Pressurized Fluidized bed gasification—During FY 1981, the two-stage pressurized fluidized bed project at Waltz Mill, Pennylvania will be continued to obtain performance data with which to assess process feasibility and economics. Design and scale-up data will be obtained on the gasifier system and components as well as data on load following characteristics, transient and failure mode behavior and control system characteristics.

c. Atmospheric entrained bed gasification—In FY 1981 the pilot plant in Windsor, Connecticut will operate in both an air-blown and an oxygen blown mode with a lignite coal and coals from Illinois, Montana and Arizona.

3. THIRD GENERATION PROCESSES

Third generation processes if successfully developed, offer the opportunity to reduce the costs associated with generating a substitute natural gas or synthesis gas from coal. The magnitude of the potential cost reduction serves as the incentive for the continued development of these concepts to the stage that the predicted advantages can be established. For pipeline gas applications, the following technology options are being developed: catalytic coal gasification, hydrogasification, and high mass flux gasifiers. In a similar manner, a molten salt gasification process is being developed for medium-Btu or synthesis gas applications. Major activities planned are:

(a) Hydrogasification—The 4 ton per hour (tph) pilot plant design was shelved in FY 1980; instead a ¾ tph PDU will operate in integrated fashion with clean-up.

(b) Catalytic gasification—PDU operation will continue in FY 1981 and design activities for a larger pilot plant will be undertaken by a new industrial partner. Exxon does not want to commercialize the process at this time.

4. GASIFICATION DEMONSTRATION PROJECTS

This activity contains projects for the demonstration of both high Btu and medium Btu coal gasification processes. In FY 1981 activities will continue in both areas.

(*a*) *The High Btu Pipeline Gas Demonstration Plant.*—Authorization to proceed with a demonstration plant project to prove the technical, economical and environmental viability of producing synthetic pipeline quality gas from coal was received in FY 1976 (project 76–1–b). Authorization for a second demonstration plan was provided by the Congress in FY 1977 (project 77–1–b).

This program includes the following demonstration plant projects for producing pipeline-quality synthetic gas:

Project A: The Continental Oil Company (CONOCO) contract employs the British Gas/Lurgi slagging gasifier as the basic coal gasification technique, and demonstrated downstream processes, such as Lurgi technology, for gas purification and water cleanup.

Project B: The Illinois Coal Gasification Group (ICGG) contract, employs the COGAS process which incorporates a "two-stage" air-blown gasifier, and staged coal pyrolysis vessels for processing the gasifier feed.

HYGAS (Conceptual Design Only): The contract with Procon, Inc., employs technology developed by IGT.

Congress has authorized the initial engineering of Projects A and B (CONOCO and ICGG) leading to detailed engineering design, construction, and operation of one demonstration plant. A selection between the two projects is scheduled by DOE for April 1980. According to the Department, the project not selected may be considered for continuation, at much slower pace, as a candidate for a second demonstration plant for which funds have been authorized and appropriated.

After the selection between the two projects, detailed design and long lead procurement will be initiated in FY 1980. In FY 1981 the construction of the demonstration plant will be initiated, and the foundation preparation and long-lead equipment procurement will be completed.

Additionally, a contract was awarded to Procon, Inc., for the conceptual design of a HYGAS commercial plant and a demonstration plant. The contract was completed in April 1979. The HYGAS pilot plant operation to validate the process design parameters and technology has been continued.

(*b*) *Low/Medium Btu Fuel Gas Demonstration Plant, Industrial.*—In February of 1980 a decision was made to proceed with the medium Btu coal gasification project proposed by the City of Memphis. The Memphis Light, Gas and Water Division (a department of the city of Memphis) in association with Delta Refining Company, Foster Wheeler Energy Corporation, and IGT, has a fuel gas demonstration program based upon the U–GAS process to produce and deliver to Memphis industrial consumers, via a pipeline distribution system, 175 million scf/d (50 billion Btu/day) of industrial fuel gas having a nominal gross heating value of 284 Btu/scf. This is equivalent to 50 million scf/d of natural gas. The IGT U–GAS process is a fluidized-bed, oxygen-steam gasification process operating under conditions which promote the formulation of ash agglomerates in the lower part of the bed.

The costs of this project have increased from an initial estimate of $300 million to $700 million. DOE is seeking a 50–50 cost-sharing agreement, but testimony from Memphis indicates that the industrial participants are proposing to contribute no more than $130 million. The plant is currently authorized at a $150 million level with $50 million available in deferred appropriations. New authorization will not be required in FY 1981.

The other proposal in competition for this project was submitted by W. B. Grace Co. for a plant that would make ammonia with the medium Btu gas. In FY 1979, Grace proposed to rescope its project to a full-size plant that would use the gas to produce gasoline with an indirect liquefaction process.

Grace's proposed full-size plant would process 29,000 tons per day of high-sulfur coal, first producing 16,000 tons of methanol which would then be chemically converted into 50,000 barrels per day of gasoline. Total costs of such a plant could be in excess of $3 billion.

Federal funds would be provided during the next 18 months for Grace to develop a conceptual design of the coal-to-gasoline facility. Since the proposed plant would be a full-size commercial venture, as opposed to a Government demonstration plant, no direct federal funding is anticipated for actual construction. Should Grace decide to continue the project after the conceptual design, however, the plant would be eligible for financial backing by the Energy Security Corporation proposed by the President.

Committee views

The Committee's Advisory Panel on Synthetic Fuels took specific note of the DOE gasification research, development and demonstration efforts. In the context of a national commitment to synthetic fuels production, improved gasification technology will play a critical role in coal liquefaction technologies as well as direct coal gas production. (This was discussed more fully in the liquefaction section.) Neither the budget justification material nor the FY 1981 Program Summary Document indicates any integration of the goals of the liquefaction and gasification programs. For example, the indirect liquefaction activities undertaken by the program do not address improvements in the gasifiers.

The Advisory Panel stressed the importance of gasification for both direct and indirect liquefaction technologies. Further, it noted that development of advanced gasifiers was necessary in order to utilize fully eastern as well as western coals for synthetic fuels production. Without the demonstration of advanced processes, the use of coal for synthetic fuels and the resultant environmental impacts will be concentrated in the western regions of our country. As a consequence of these judgments, the Advisory Panel recommended that the competition be suspended between proposals for the different gasification demonstration projects in order to speed the development of a number of gasifiers.

The other general point made by the panel concerns the importance of early and substantial private financial participation in pilot plants and demonstration projects. The Panel did not define quantitatively the level of participation required; however, it disturbs the Committee to note that the hydrogasification process which will operate in an integrated mode has no contractor contribution in the project and that the Gas Research Institute has withdrawn its funding. The Committee feels it is unnecessary to build a pilot plant for the catalytic gasification process, when Exxon is not interested in participating. The Committee will strongly support the early demonstration of advanced gasification technologies. However, the Committee is also convinced that there is little point in continued federal support of processes when the industrial sponsor is unwilling to show his confidence in the process by putting himself at risk. This is particularly so in the light of the probable establishment of a synthetic fuel production capability and as world oil prices continue to increase faster than inflation.

As with the liquefaction program, the gasification program will begin at least two major, very costly construction projects in FY 1981. The Committee will be especially concerned with the management of these projects.

Committee Actions

The Committee decreased operating funds by $8 million. In the construction fund request, the Committee reduced the authorization request for the first High Btu Synthetic Pipeline Gas Demonstration Project by $188 million; this amounts to a $50 million reduction in BA. The Committee then authorized an additional $38 million for the second High Btu Synthetic Pipeline Gas Demonstration Project; this amounts to a total authorization of $48 million and a recommended BA of $46 million for FY 1981.

The decrease in operating funds affects the catalytic gasification project ($6 million) and the hydrogasification project ($2 million) in Third Generation Process activities. The intent of this decrease is to stop or slow down the activities geared at large scale pilot plant design and construction. The Committee questions the value of these activities as long as the private sector participants have no significant funding commitments in the projects. This action is in keeping with the recommendations of the Committee's Advisory Panel on Synthetic Fuels.

In the case of the Synthetic Pipeline Gas Demonstration Project, the Committee actions are again in keeping with the Advisory Panel's recommendations. The intention here is to stop the competition between the CONOCO and ICGG projects. The Committee feels the demonstration of advanced gasification technology is so important, that both projects should proceed as soon as possible. However, the Committee directs DOE to negotiate contracts, which are mutually advantageous to all parties but which also assure significant cost sharing and accountability from the private sector. In addition, the Committee understands that originally a choice was to be made between the two projects in April or May of 1980, but now understands that this choice would be delayed until late FY 1980. The Committee wishes both parties to proceed in a timely fashion and in furtherance of this objective, the Committee has split the two projects, carrying ICGG under the 76-1-b project line. This accounting move is meant only to emphasize that the two projects are to move forward expeditiously and independent of each other, in no way is it meant to alter the existing contractual arrangement between DOE and the project sponsors or among the sponsors of a project themselves. It further directs the Department to ensure the acceleration of the regulatory processes for each project concurrent with contract negotiations.

The Committee also notes and approves the Department's decision to proceed with the Memphis Light, Water and Gas Division's medium Btu coal gasification project for demonstration project 77-1-c. It understands that the $150 million currently authorized for the project is sufficient for the project in FY 1981. It expects that the Department will request the release of the $50 million currently deferred and will subsequently request any additional appropriations required for the project in FY 1981.

(e) IN SITU COAL GASIFICATION

Program Description

The goal of the in situ coal gasification program is to develop at least one underground coal gasification technology to the stage of commercial application by the middle to late 1980's through joint government-industry efforts. The expected products from this technology will be transportation fuels such as methanol and gasoline, synthetic natural gas, or electric power.

The major objectives of this program are:

1. Accelerate the development of environmentally acceptable in situ technologies for converting currently unmineable coal into liquid or gaseous fuels.
2. Demonstrate the viability of producing medium-Btu gas from steam oxygen underground coal gasification to provide a suitable chemical feedstock.
3. Increase the data base necessary for development of economically viable in situ conversion processes.
4. Work actively with industry through cooperative agreement to insure maximum technology transfer and a sufficient pool of trained manpower to utilize these technology.

The four major in situ gasification process options being developed as part of DOE's In Situ Coal Gasification Activity address the wide range of chemical and physical properties of the coal seams and surrounding geology found in the United States.

1. A Low-Btu Gasification project is concentrating on gasifying shrinking subbituminous coal with air injection after linking pairs of wells using reverse combustion.
2. A project is concentrating on gasifying shrinking bituminous or subbituminous coal with oxygen and steam injection after linking pairs of wells using directionally drilled holes.
3. A Steeply Dipping Bed (SDB) project is concentrating on gasifying coal seams which dips more than 35° F and are not commercially exploitable with conventional mining technology.
4. A project is concentrating on gasifying swelling bituminous coals using the best available technology.

The President's revised budget request decreases this activity by $5 million and would put the program in a position of providing only limited technology base support.

Committee action

The Committee disagrees with the Administration's decision to decrease this program. The original request for the program was level with last year; the further reduction makes it virtually impossible to interact effectively with the private sector and reduces it to a subcritical level. The Committee sustained the original request.

(f) ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

Program Description

The main objectives of the Advanced Research and Technology Development (AR&TD) activity are to:

1. Provide a focal point for advanced research on coal and for program coordination activities for all Fossil Energy programs.
2. Explore and develop new and advanced processes for converting to clean gaseous and liquid fuels and chemical feedstocks.
3. Accelerate direct substitution of coal into the industrial and utility sector through the development of improved pulverized fuel and synfuel combustion processes and generic heat exchanger and advanced environmental control system technologies.
4. Assure reliable efficient operation of fossil fuel plants through development of improved materials and components.
5. Provide technical assessment, environmental, and systems engineering assurance support to Fossil Energy programs.
6. Provide integrated planning, fiscal, and general management support for Fossil Energy programs.

Four basic areas are supported under this program. The materials and components used in advanced coal conversion and combustion processes must operate under more severe conditions than previously to attain higher efficiencies. Thus, important basic, exploratory and engineering design work is supported to find and test materials and components for specific processes under investigation by the Fossil Program. Advanced fossil fuel conversion processes are also explored along with environmentally acceptable coal utilization processes for beneficiation and combustion.

These three efforts compose the basic research program in Fossil Energy. Although basic research often is process-related, it is less controllable in terms of timing the results. It is important, however, to keep in mind that basic research drives the scientific process. It seeks fundamental understanding not simply engineering control. It does not necessarily get a job done today, but it will make it possible to see new ways of doing the job tomorrow. Essentially basic research is a hedge against the future that requires continuing support today.

The Program Development and Coordination subactivity provides for long-term strategy and planning, program review and analysis, financial planning, program integration support process engineering, economic and environmental planning and assessment for all Fossil Energy facilities and programs.

This activity also continues the University Coal Research program initiated by Congress in FY 1980. The intention is to support basic coal research and universities without the institutional superstructure of the "University Coal Laboratories" defined in P.L. 95-87. The program developed by DOE will include the following topics:

1. Combustion of coal and synthetic fuels;
2. Coal characterization and specificity at related to liquefaction and gasification processes;
3. The structure and reactions of coal and analysis of its conversion products;
4. Multi-phase flow phenomena related to coal conversion processes;
5. Fundamental problems of reactor engineering; and
6. Environmental aspects directly related to coal conversion processes and coal utilization.

The AR&TD activity also serves as the home for construction and general projects for the Energy Technology Centers. The FY 1981 authorization request for these projects is $16,300,000. The projects included in the request are as follows:

1. General plant projects, $6,000,000;
2. Program support facility, $7,800,000 ($2,200,000 requested in appropriations), Pittsburgh Energy Technology Center; (PETC);
3. Surface water containment and waste treatment facility, Pittsburgh Energy Technology Centers, $1,300,000.
4. Renovation of South Wing Building No. 3, Bartlesville Energy Technology Center, $1,200,000.

Committee views

With the Department's commitment to largescale construction projects in the gasification and liquefaction programs, it will be increasingly important for the materials R&D program to operate in close support with the component procurement and quality assurance and control elements of these projects. Successful dependable operation of these new processes will require components and materials capable of withstanding very severe process environments. As these projects go forward, the Committee will pay careful attention to the coordination of the AR&TD activity with the demonstration program.

Committee actions

The Committee increased operating expenses by $3 million. The Committee decreased the authorization request for construction funds by $9,900,000; this is a decrease in budget authority of $4,300,000.

The increase of $3 million is to be used to continue the development of several dry-coal feeder technologies. The injection of coal directly into a pressurized environment is generally accomplished either in batch with a lock hopper or in a slurry. New methods for coal injection will improve the overall economics and efficiencies of systems like coal gasifiers and pressurized fluidized bed combustion systems.

The projects affected by the Committee's action are:

(1) Program Support Facility, (PTEC)—authorization was decreased by $5,600,000. The Committee authorized $2,200,000, which is the appropriation requested for FY 1981.

(2) Surface Water Containment and Waste Treatment Facility, PETC—the facility is not required until 1984. The Committee has deferred authorization until FY 1982.

(3) General Plants Projects—authorization is decreased by $3,000,000, which stretches out various projects, including equipment storage facilities, roof replacement, boiler replacement, and fire protection items.

(g) ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

Program description

Close to 90 percent of the coal consumed in this country is, and will continue to be, burned directly. If coal consumption increases as part of a strategy to decrease oil imports then we must also assure that stationary facilities burning coal can continue to do so while meeting applicable environmental standards. Unless new technologies are available for meeting new and existing environmental standards, many facilities that might use coal will turn to other fuels.

The goals of the Advanced Environmental Control Technology Activity are to identify, research, develop, refine, and demonstrate a range of engineering approaches capable of:

(1) removing flue gas pollutants for compliance with emission standards,

(2) removing undesirable components from process streams produced during gasification and/or combustion, thus protecting utilization equipment such as turbines, fuel cells, and heat exchangers.

The Advanced Environmental Control Technology Activity effort is composed of three subactivities: (1) Flue gas cleanup; (2) Gas stream cleanup; and (3) Cleanup base technology.

1. The flue gas cleanup activities address technology development issues for present and advanced desulfurization systems as well as combined flue gas cleanup systems which address jointly sulfur oxides, nitrogen oxides and particulate removal. In FY 1981, DOE will participate in the EPRI-sponsored flue gas desulfurization (FGD) characterization tests. Data from these tests will provide a basis for the maintenance guide and design manual efforts which will be pursued in parallel with the characterization program. Preliminary manuals will be prepared in late FY 1981 and updated periodically as information becomes available through FY 1984. A large scale test of either an organic or inorganic additive for improved reliability and SO_2 capture will be performed in cooperation with EPA. One attractive prospect is adipic acid which has been demonstrated in pilot scale scrubbers and has the advantage of retrofit applications. Operation of the 10 MW spray tower and turbulent contact absorber scrubbers at TVA's Shawnee plant will be continued for improved performance and SO_2 removal efficiencies. Selected commercial FGD systems will be monitored in cooperation with industry to obtain operability and maintenance data required in pinpointing problem areas for concentrated applied effort.

In FY 1981 the Department plans to complete the funding requirements for the test and evaluation plan for the aqueous carbonate regenerative scrubber demonstration, continuation of the monitoring and evaluation of a full-scale dry scrubber at a western utility, continued operation of the dry scrubber pilot plant for high sulfur eastern coals initiated in FY 1980, and evaluation of a full-scale utility dual alkali scrubber (currently utilizing carbide lime).

The planned particulate control activities will include the continuation of the long term monitoring of a western utility baghouse application, completion of a pilot plant evaluation of electrostatic precipitator (ESP) conditioning agents for western coals and initiation of efforts to evaluate, construct, and test on-line sensors for fine particle and organic emission control in conventional combustors and for sorbent and burnup cell control for fluidized bed combustors. This improved technology has the potential of reducing the cost of electrostatic precipitators for the control of fly ash from low sulfur coals by a factor of 2 to 5.

2. Gas stream cleanup. This area includes technologies that remove pollution during the combustion process or prior to the combustion process. Such technologies must be integral parts, for example, of Gasifier Combined Cycle Systems, Pressurized Fluidized Bed Combined Cycle Systems and Molten Carbonate Fuel Cell Systems. For Gasifier Combined Cycle Systems, both the SO2 and to a small extent particulates must be scrubbed from the gas stream before the stream enters the turbine inlet for combustion. In PFB systems, limestone in the fluid bed removes SO2 sufficiently but the particulate carryover is very high. Thus, for PFB systems, the major problem is particulate removal at high temperatures in order to prevent corrosion of the turbine blades. Molten Carbonate Fuel Cell Systems will use fuel for which SO2 must be controlled in order to prevent catalyst poisoning, electrode damage, and electrolyte contamination.

The major effort in turbine cleanup systems in FY 1981 will concentrate on the continued laboratory development of the innovative particulate and alkali removal concepts initiated in late FY 1979 and FY 1980. These include magnetic and electrostatic granulate bed filtration, ceramic membrane filtration, acoustic agglomeration and dry plate scrubbing. The combined cyclone-centrifuge particulate removal device will be tested with a fixed bed gasifier.

In FY 1981 efforts in fuel cell cleanup are primarily concentrating on completion of a number of key efforts for the definition of an integrated cleanup system for the 0.5 MW molten carbonate fuel cell stack. These include a trade-off study of cell life as a function of fuel gas contaminant loading; selection of a gasification process for fuel cell applications; evaluation of commercial desulfurization processes and evaluation of elevated temperature cleanup versus cold cleanup with heat recovery.

3. Cleanup Base Technology. The cleanup base technology subactivity will develop the "cross-cutting" technologies in areas such as waste management, instrumentation and process controls, and systems and economic comparisons, which are common to both flue gas and gas stream cleanup technology requirements. In addition, innovative concepts will be pursued. Specific FY 1981 efforts in waste management intended by DOE include technology development for disposal of waste materials from lime/limestone scrubbers to satisfy RCRA requirements; the development and testing of methods for generation of FBC sulfur sorbents to increase overall sorbent utilization and reduce waste outputs; the initiation of studies for treatment, utilization and disposal options for wastes associated with advanced flue gas cleanup

processes. The comprehensive assessment of the impact from proposed RCRA and other Federal regulations on utility and industrial coal burning sectors as well as the companion inter-laboratory activity on fossil technology waste sampling and characterization will be completed. Instrumentation to be tested in FY 1981 are expected to include on-line sulfur and ash meters, pH monitors and sensors, and reliable particulate monitoring devices, especially for minus 2-micron respirable particles. Efforts to measure trace element emissions will also be initiated.

The object of the applied research project is to provide the scientific base for development of flue gas and gas stream cleanup technologies. Results of this task will enhance the development of control systems. Efforts will focus on systems and materials testing and chemical and physical effects related to cleanup technologies. Specific efforts in FY 1981 will include the determination of corrodant formation control parameters in coal gasification and combustion; the development of hydrodynamic and reaction models of contaminant composition in gasifiers and pressurized fluidized bed combustor gas streams.

Committee action

The committee decreased operating expenses by $5 million.

Funding for this program was increased dramatically between Fiscal Year 1979 and 1980; the committee action basically keeps the program level with FY 1980. This does not reflect a judgment on the part of the committee that environmental control technologies are not important. On the contrary, the committee feels strongly that any DOE policy for coal utilization must be accompanied by a very strong commitment to environmentally acceptable use. In this case, the $5 million decrease is intended to be taken from the Flue Gas Cleanup and Cleanup Base Technology activities. It is the feeling of the committee that the current regulatory and economic situation for utilities should drive the development and utilization of new environmental control technologies. Further, there is a number of high technology firms already involved in the development and marketing of advanced cleanup technologies. The committee is not convinced of the need for a DOE presence in this area. Further, the committee would like to see a program plan for this activity before the program grows significantly.

The committee wishes to give definite support to the Gas Stream Cleanup activities since they are tied to the longer term technologies of fuel cells and pressurized fluidized bed combustion. The committee does not wish these technologies to be deferred; it also does not see a commensurate independent private sector market or development activity that would overlap with a Federal effort.

(h) HEAT ENGINES AND HEAT RECOVERY

Program Description

The goal of this program is to provide advanced stationary power systems capable of using coal, coal-derived liquids and gases, residual petroleum, and waste heat from fossil fuel combustion sources. There are three objectives for achieving this goal:

1. By 1990–2000, develop high-efficiency central power systems that allow electrical utilities to utilize a wide variety of domestic coals directly in an environmentally acceptable manner, with particular emphasis on advanced gasification combined cycle applications.
2. By 1985–1990, develop advanced dispersed power system technologies that provide for more efficient fuel utilization, and that permit industrial and residential/commercial stationary power plants to use noncritical fuels in a durable and environmentally acceptable manner, with particular emphasis on coal cogeneration applications.
3. By 1980–1985, develop technologies that will allow cost effective recovery of waste heat in utilities, industrial, and residential/commercial areas, and from Federal facilities, with particular emphasis on waste heat streams at temperatures from less than 200° F to as high as 1000° F.

There are three major subactivities: central power systems, dispersed power systems, and heat recovery component technology.

1. The major effort in the central power systems area is in the High Temperature Turbine Technology (HTTT) project.

Present utility class gas turbines are not capable of burning coal nor are they proven on the basis of durability as baseload power plants. The objective of the project is to develop a high firing temperature capability for gas turbines so that they can be used in baseload coal gasification combined cycle central station utility power plants. Temperature goals in the range of 2000° F to 3000° F have been established in order to offset energy losses in gasifying and cleaning the coal.

Phase I, Program and System Definition Studies of the HTTT project, was completed by four contractors in July 1977. Following Phase I, two contractors were chosen for the Phase II effort, Technology Testing, which is to be completed during FY 1980. Two advanced turbine cooling schemes are being evaluated in this phase: advanced air transpiration cooling and advanced water cooling. The tasks include design and fabrication of test support equipment, design and fabrication of test components and specimens, followed by the actual technology tests and data analysis. Successful completion of this effort on the planned schedule will provide the experimental data necessary for design, construction and testing of a Phase III gas turbine subsystem in order to establish technology readiness for subsequent private sector development.

2. The goal of the dispersed power systems area is the development of decentralized power systems for efficient onsite applications such as industrial cogeneration and small utilities. A major emphasis here is on stationary engine diesel and gas turbine technology permitting the environmentally acceptable use of lower grade petroleum fuels and alternate liquid fuels derived from coal or shale oil. The development of advanced industrialized engines capable of being fired with coal or coal-derived fuels would enhance industrial cogeneration and provide both municipal and rural utilities the capabilities of using coal in power producing units previously considered too small to be economically fired with fuels other than distillate oil and natural gas.

The technologies under development by the dispersed power systems area were reviewed and evaluated by the Cogeneration Technology Assessment Study (CTAS) which was completed in mid 1979. In the near-term, the CTAS identified the atmospheric fluid bed combustor combined with either a steam turbine or an open cycle gas turbine as the most promising technology for direct coal-fired cogeneration.

3. The major effort in the heat recovery component technology subactivity is the Residual Energy Applications Program (REAP). FY 1981 funding will be used to continue this program. The overall objective of this project is to develop technology to utilize waste heat at temperatures under 200° F with particular emphasis on application to energy recovery from process cooling water at DOE facilities. Energy currently rejected in the processing cooling streams at the three DOE gaseous diffusion plants and the Savannah River special materials production plant is in excess of 6000 MW, all of it for the most part being below 150° F.

The specific objective of this project is to stimulate institutional and organizational change that allows implementation and utilization of residual heat recovery technology. It will be carried out with considerable industrial participation featuring application feasibility experiments in a "real world" environment, and the conduct of on-going technology development and systems R&D activities that focus on cost effective heat recovery.

The Administration's revised budget request reduces the dispersed power systems activity by $7 million. The reduction will result in a stretchout in the development of large and small Stirling engines, small stream turbine and open cycle gas turbines (combustor and materials). Diesel testing will be reduced. The major emphasis for the overall program for FY 1981 will be on maintaining the schedule of development of the HTTT effort.

Committee Actions

The Committee increased operating expenses by $2.5 million for conceptual design of a cogeneration demonstration project.

The increase will permit the Department to implement the conclusions and recommendations of the Cogeneration Technology Alternatives Study (CTAS), which studied the technological opportunities for coal-utilizing cogeneration technologies. The most promising near-term technology was direct coal-fired atmospheric fluidized bed-steam turbine systems. In addition, the study also examined technologies that could utilize coal derived fuels including liquids and gases. The Committee feels that the Fossil Program as well as the Industrial

Cogeneration program in DOE have not focused strongly enough on the opportunities of direct coal fired cogeneration. This increase is intended to emphasize this kind of cogeneration applications.

The Committee disagrees with the Administration's decision to reduce the dispersed power systems activities. Direct coal-fired cogeneration technology offers a near-term opportunity to reduce use of oil in the industrial sector. The technical and institutional problems facing broad use of cogeneration must be addressed simultaneously. Thus, the Committee retained the $7 million in the original budget request.

(i) COMBUSTION SYSTEMS

Program Description

The objectives of the Combustion Systems activity are to—

1. Develop fluidized-bed combustion systems capable of directly burning high-sulfur and other coals of all ranks and quality in an environmentally acceptable manner.

2. Develop technology to substitute coal for a substantial portion of oil in combustors capable of firing coal-oil or other coal-based mixtures.

Specific areas of research and development include:

1. Development of fluidized-bed combustion (atmospheric and pressurized) with particular attention to achieving high combustion efficiency, acceptable component durability, minimum emission of particulates and sulfur and nitrogen oxides, and reliable operation of combined-cycle systems.

2. Determination of combustion and heat transfer characteristics of chars, coal-oil mixtures (COMs), solvent refined coal, and coal-derived liquids fuels when burned in conventional equipment and the application of such data to improved combustion component design.

3. Determination of the causes of adherent slag and ash deposits, and development of methods for minimizing their effects on reliability and efficiency.

4. Identification and control of toxic elements evolved during the direct combustion of coal.

The major elements of Combustion Systems involve atmospheric fluidized bed (AFB) systems development, pressurized fluidized bed (PFB) systems development, advanced combustion systems and coal-oil mixture (COM) utilization. In FY 1981 the budget request would support the following major activities:

1. AFB Systems

(*a*) AFB Industrial Applications: construction of on-going projects at various sites will be completed and operations will either continue or begin;

(*b*) AFB-Component Test and Integration Unit, Morgantown, West Virginia: construction and boiler installation would continue through FY 1981;

(*c*) AFB-Anthracite Applications—construction for two projects will continue in FY 1981; the Shamokin unit is scheduled to start-up in mid-FY 1981; the units will produce steam for space heating applications and are cost-sharing with industry.

2. PFB Systems

(*a*)PFB Combined Cycle Pilot Plant, 13 MWe: the revised request permits the base experimental program to continue but stretches out the original construction schedule, which will begin in FY 1980.

(*b*) International Energy Agency PFB Facility, Grimethorpe, England: Operation in FY 1981 will permit gathering of detailed data on the PFB combustion process in equipment sufficiently large to apply to utility systems. Such data will include profiles of fluidization, bed mixing, coal injection, combustion and sorbent kinetics, particle and alkali elutriation, and associated information necessary to engineer reliable utility systems. The plant will be expanded by adding gas-turbine performance facility for a range of blade temperatures and a variety of blade materials.

3. Coal-Oil Mixtures

(*a*) Early utilization of coal-oil mixtures is a priority item in the FY 1981 budget request as part of the Administration's oil import reduction program. The FY 1981 request of $22 million is a major increase over the $2.5 million in the FY 1980 budget. The $22,000,000 would be used for accelerated coal-oil mixture (COM) engineering technology support at our Pittsburgh Energy Technology Center (PETC) and to support a Program Opportunity Notice (PON) which was released on November 14, 1979. The PON was designed to demonstrate COM in two existing oil designed utility boilers, an existing oil designed industrial boiler, a new COM designed industrial boiler, and the commodity purchase of COM.

Committee Views

The Committee has long been a supporter of the technologies in this activity. The direct environmental benefits of fluid bed combustion combined with the indirect environmental benefit of more efficient coal utilization (i.e., less coal needs to be mined) makes this area and the other associated activities in the coal program at least of equal priority with the synthetic fuels efforts.

The Department's program overemphasizes utility applications of atmospheric fluid bed combustion at the expense of industrial uses. TVA has committed itself to developing an AFB utility option; further, within the broader utility and vendor community, there is growing interest and conviction that the right technology for the utility market is the PFB. Thus, the Committee feels strongly it is time to change the emphasis of the fluidized bed combustion programs. Industrial uses of large AFB boilers should be further developed and stimulated, and PFB technology should not be delayed as proposed in the Administration's revised request.

The Committee's views on coal-oil mixtures are discussed more fully in the context of its actions.

Committee Actions

The Committee decreased operating expenses for combustion systems by $18.5 million. This action consists of both increases and decreases:

1. −$18 million from coal oil mixtures ($7 million is transferred to plant and capital projects).
2. −$3 million from Rivesville AFB pilot plant operation.
3. +$2.5 million for innovative coal combustor technology development for industrial retrofit.

The Committee decreased plant and capital funds by $2.935 million. This action consists of several increases and decreases:

1. +$10 million for industrial atmospheric fluidized bed demonstration projects; 81–T–405,

2. −$19.935 million from the atmospheric fluidized bed-component test and integration unit (AFB–CTIU). This consists of a decrease of $9.935 million from the FY 1981 request and a deauthorization of $10 million of prior year funds, project 80–FE–10,

3. Transfer of $7 million from operating expenses to plant and capital funds for coal-oil mixture projects, 81–T–406.

The recommendation to decrease funding for the coal-oil mixture activity does not indicate lack of support for the technology. However, the solicitation recently released by DOE for feasibility design studies under the appropriations from PL 96–126, includes coal-oil mixture preparation facilities as candidates for support. Some of the funding within the $22 million in the budget request was to be used for preparation facilities and the provision of fuel to the demonstration projects. Furthermore, the synthetic fuels title of S. 932 presently in conference includes coal-oil mixture preparation and utilization facilities as eligible for assistance. The Committee's action recognizes these new incentives. However, the Committee wishes to protect ongoing research by the Pittsburgh Energy Technology Center and university contractors. Since the Synthetic Fuels Corporation created by S. 932, will not come into existence until FY 1981, the Committee set aside $7 million for coal-oil mixture demonstrations as a line item construction project. This will support engineering design for three projects to meet the requirements of the Energy Regulatory Administration for demonstration of coal-oil mixtures as an alternative fuel. The Committee wishes these projects to represent both the utility and industrial sectors.

A $3 million decrease for the Rivesville AFB pilot plant will terminate the operation of the project at the end of FY 1980. Rivesville has never operated satisfactorily as an AFB unit. It has provided a test bed for certain kinds of coal handling and feeding equipment and an opportunity to gain experience with the operation of an overall AFB system. However, it is unlikely that a commercial utility AFB unit will ever be built using the Rivesville design.

The Committee also added $2.5 million to begin the development, test and evaluation of a retrofit coal combustion system for industrial boilers. Significant near-term savings of oil and gas can be achieved in the industrial sector if a simple method can be found to convert these boilers to coal. The major problems are adapting the smaller oil and gas boilers to the combustion characteristics of coal and removing most of the ash prior to entry into the oil and gas boilers. The program initiated by this increase is intended to be a short term activity with quick impact. The Committee realizes that future funds may be required and wishes the Department to provide full information on its evaluation of the technologies available for this kind of retrofit before the FY 1982 budget cycle.

In the plant and capital equipment funds for Combustion Systems, the Committee added $10 million for industrial atmospheric fluidized bed projects. This will permit the detailed design and initial construction activities for at least three cost-shared projects. The Department received responses to a program opportunity notice (PON) in late FY 1979; all of the responses proposed at least a 50 percent private cost sharing. These projects complement the smaller AFB projects that are either on line or will come on line during FY 1980. The PON was geared toward the larger industrial user (approximately 200,000 lbs. of steam per hour) and could be a major factor in the transition of the AFB technology for cogeneration applications. The Committee views this action on the industrial AFB demonstration project as coordinated with the conceptual design activity added to the Heat Engines/Heat Recovery program for a cogeneration demonstration.

The FY 1980 budget contained $4.3 million for this activity and the FY 1981 budget request contains no funding for this activity; thus, the program would have come to a halt in FY 1981. Given the strong industrial response, both in terms of numbers and willingness to cost share, it seems unwise to the Committee not to fund a technology that is so clearly on the edge of utilization. It is this kind of activity that the DOE is explicitly intended to pursue.

The Committee decreased funds for the AFB–CTIU by $19.935 million. This is a decrease in the FY 1981 budget request for $9.935 million and a deauthorization of prior year funds of $10 million. This project was begun in FY 1977 and intended to be completed in FY 1980; the original cost was estimated at about $37 million. The current expectation is that it will be operational in June 1982 and cost approximately $58 million. Poor management and cost control on the part of headquarters caused the unacceptable delay and cost escalation of this project. In the meantime, TVA decided to build its own 20 MW AFB utility test unit which will come on line in May 1982, a month before AFB–CTIU. TVA has also virtually committed itself to a 200 MW AFB unit depending on the result of its test.

In November of 1979, the GAO examined this project in a report on the overall outlook for fluidized bed combustion technology. It noted that the overruns and delays of the AFB–CTIU combined with the commitment of TVA to its own unit made the AFB–CTIU superfluous to both the DOE program and the national effort to develop utility applications for atmospheric fluidized bed combustion.

The Committee also understands that a stop-work order has been issued by DOE itself for this facility and they are considering rescoping the project. The Committee's action is a clear indication of its displeasure with the management failure displayed by DOE. Failures such as this only enhance the Committee's concern when faced with the requirements of the other large demonstration projects that the fossil energy program has undertaken.

(j) FUEL CELLS

Program Description

Fuel cells are highly efficient, modular, environmentally acceptable energy conversion devices. They are being developed to operate on a range of gaseous fuels. Since they operate in a clean and quiet fashion it was possible to site an experimental 4.8 megawatt fuel cell power plant on the Consolidated Edison grid in Manhattan, a non-attainment area. When appropriately sited, the heat produced in the generation of electricity from the fuel cell can be used to meet the thermal needs of consumers and most distribution and transmission losses can be avoided. With cogeneration, more than 80% of the energy value of the fuel can be put to practical use, compared to the 30–35 percent efficiency for today's conventional power plants. Fuel cells have very low emission levels for NO_x, SO_x particulates and hydrocarbons. The ECAS study has predicted that the second generation molten carbonate fuel cells when integrated with low Btu coal gasifier and bottomed with the steam turbine could deliver electricity at 50% efficiency and at a competitive cost. Molten carbonate fuel cell technical development lags that of the first generation phosphoric acid technology by 5 to 8 years.

The goals of the fuel cell program are to establish the operational and commercial feasibility of fuel cell systems and energy saving applications as soon as possible; to lower the cost and increase endurance for first generation fuel cells; to establish the technical feasibility of second generation systems; and to generate the capability for reliable economic use of a broad range of fuel cells.

The phosphoric acid systems fuel cell program for FY 1981 will continue programs initiated in FY 1980. Building on FY 1980 engineering and development work, a pre-prototype 40 kilowatt power plant will be fabricated and a performance verification test will be completed. Work will continue on a program to design, fabricate and test full-size integral cell stacks for an electric utility power plant, which is a pre-requisite to commercialization since the 4.8 megawatt power plant in New York is not expected to meet the cost and endurance requirements of production fuel cell power plants. Work will also continue on optimization of ribbed substrate material and on the testing of three partial cell stacks for 10,000 hours. It is hoped that by FY 1983 sufficient performance and production cost data will be gathered to allow for accurate estimates of mass production costs and a decision on the future of the program.

During FY 1981 the molten carbonate fuel cell program will complete the transition begun in FY 1979 from an applied research program to an effort that is primarily exploratory development. Major emphasis will be put on the least advanced components: stability of electrolyte structures under thermal cycling, tolerance to contaminants in a feed stream, and reduction of evaporative losses of electrolytes.

A reference design for proceeding from exploratory development to technology development should also be completed in FY 1981.

In FY 1981 $3 million is provided for identification, research and development, and demonstration of advanced concepts, new direct conversion technology aimed at significant advancement in the State-of-the-art. Solid oxide fuel cells and thermionic energy conversion are presently being investigated as possible systems that many warrant development and demonstration. Emphasis will be placed on the development of the technology base with operating temperatures of about 2000° F. Operation at this temperature requires R&D to improve the performance of converters, the development of protective coatings, and the development of pre-prototype thermionic modules which will be tested in a simulated furnace environment.

Committee action

The Committee increased this activity by $12,000,000, including $10 million for the field testing and continued development of phosphoric acid fuel cell systems of 100 kilowatts or less, and $2 million for utility applications. The Committee also did not concur in the Administration's revised request which would have reduced molten carbonate fuel cell research by $3 million and advanced systems research by $2 million; the Committee retained the original request.

The Committee action represents a clear commitment to continued research on multi-kilowatt phosphoric acid fuel cell systems and to a multi-year field test using these technologies. Of the $10 million for phosphoric acid systems of a 100 kilowatts or less, approximately half will be devoted to the field test while the remainder is allocated to continued technology development of alternative concepts for this application. The Committee is excited by the promise of these systems and feels much is to be gained by a field test program in which the utilities begin to get hands-on experience with units of this size. The Committee, however, also is aware of the NASA-Lewis technical evaluation of the 40 kilowatt phosphoric acid system and does not want to commit prematurely to a large scale test of these units. Rather, the Committee wishes the field test program to begin by using a few pre-prototype units; additional improved units should be phased in over the life of the program. In this manner, it is hoped that technology development and operating experience can be factored in to the later phases rapidly enough that bona fide prototype units capable of meeting commercial operating and endurance standards are tested in the final phase.

Two million dollars is also provided to accelerate the development of alternative concepts for phosphoric acid systems directed at the electric utility market. The Committee recognizes both the benefits of fuel cells in general and of having air and water cooled models to choose from.

(k) MAGNETOHYDRODYNAMICS (MHD)

Program description

The magnetohydrodynamics (MHD) program is a long range effort to develop a method for burning coal with approximately 50% efficiency. In the MHD process, coal is burned in several stages to heat the air to an extremely high temperature of 4600°. This temperature causes the air to ionize and become a plasma. The plasma is passed from high temperature combustor into a channel at a very high velocity, therefore powerful magnets are used to induce an electrical field within the plasma. If electrodes are present, DC current can be collected and then supplied to the utility power grid after going through a DC/AC inverter.

After passing through the magnets, the combustion products leaving the MHD generator are no longer appreciably conductive but they still have temperatures in the range of 3000 ° F. This remaining heat is used to boil water and produce steam that drives a commercial steam turbine generator thereby improving efficiency of the overall MHD system.

The potassium carbonate seed which is injected into the high temperature combustor to allow adequate levels of electrical conductivity also has unique pollution prevention properties. It reacts preferentially with sulfur produced by burning coal thereby forming potassium sulfate. The potassium sulfate can be generated into potassium carbonate to recover the seed and to separate the sulfur. It is expected that the MHD system will achieve sufficient levels of sulfur removal to meet EPA's new source performance standards without extensive preprocessing of coal or stack gas cleanup. Recent experimental and analytical evidence of MHD has promise for achieving very low NO_x emission levels as well.

The process as described above is known as open cycle MHD. Two closed cycle MHD processes are now under investigation, one involving a plasma and another involving a liquid metal. The principal U.S. closed cycle approach is the plasma system where argon seeded with cesium to enhance its electrical conductivity is cycled through the MHD flow train steam system. Closed cycle temperature can be as low as 3000 ° F. To maintain the required system conductivity, the argon flow must be kept free of contamination by combustion prior to passage through the closed cycle generator. Although quality work is being done in the closed cycle MHD area, pursuing closed cycle MHD is a low priority within DOE and once again this is the subject of proposed budget cuts.

Although initial development of MHD began in the 1950s, a large scale effort in MHD did not begin until the 1970s during which the MHD appropriations increased 125-fold from $600,000 in 1971 to $80 million in 1979. The money spent today is small fraction of the amount necessary to bring the technology to the demonstration plant level.

In the mid-1970s the energy conversion alternatives study (ECAS) concluded that the combined open cycle MHD/steam system offered the greatest potential among advanced energy conversion systems for significant improvement in overall plant efficiency and cost. However, MHD was estimated to require the longest time for development at considerably higher cost than the alternatives.

In October 1978, the staff report on MHD technology was published by the Committee on Fossil and Nuclear Research, Development and Demonstration of the Committee on Science and Technology. That report concluded that given enough time and money there was no unsolvable problem in the development of MHD power generation for commercial applications and that the remaining problems are those of engineering, not physics. It stated that MHD had reached a state of maturity both in number and variety of participants, and a level of Federal funding that a comprehensive plan was a necessity if orderly cost effective progress was to be made towards commercialization. The report recommended that the Department of Energy give completion of the comprehensive program and plan for MHD development the highest priority, and aim for publication of the plan at the earliest possible date. It further recommended that no additional funding for work beyond the current component development and testing stage should be authorized by Congress until such time as the comprehensive program being prepared by DOE had been received and found acceptable by the Committee. Since that time the Department has done considerable work towards developing a plan and now feels that both time and money can be saved from earlier estimates; however the plan has never been submitted and approved in final form.

We are currently in Phase I of the MHD program which involves operation of a component development and integration facility (CDIF) which will provide the knowledge base for the second phase, that is the design, construction and operation of the commercial prototype MHD power plant, the engineering test facility (ETF). Other work in the MHD program is being conducted in numerous facilities around the country in fifteen states.

There are five major activities in the MHD open-cycle program.

1. CDIF Project: This CDIF is a major test facility of Phase I of the MHD program. The requested funding will provide limited support for the CDIF major component fabrication, integration and operation costs. The CDIF will permit continuous testing of engineering scale power trains of 50–100 megawatts thermal. Full scale testing of major components for flow 1–A (supersonic channel—conventional magnet) and 1–D (subsonic channel—superconducting magnet) will be initiated in FY 81. Procurement will also be initiated on an advanced second generation power train, which will result in maximum utilization of the CDIF test facility in the future.

2. Engineering Development: Included here is continued funding for the Coal Fired Flow Facility (CFFF) located at the University of Tennessee Space Institute. This is a government owned test bed for generator development activities prior to scale-up which also will be used for extensive downstream heat and seed recovery development work and early environmental monitoring of actual coal-fired MHD facilities. Also included is the Arnold Engineering Development Center high-performance demonstration experiment which will demon-

strate at large, 250 megawatt thermal level MHD turbine efficiency and enthalpy extraction. If the joint U.S./USSR program is back on track by FY 81, it will be funded out of this line as well. Also funded is subscale development of major components including limited support for three competing 20 megawatt thermal combustor designs. Only one contractor will be permitted to proceed into development.

3. Engineering Test Facility: The budget request in this area is cut in half to $400,000. All activity directed toward design and construction of the ETF is funded here. The decrease here reflects the decision to start Title I work on the ETF after FY 1987.

4. Systems Engineering: This item is directed at overall guidance and definition for development of the MHD program, as well as specification of component design, parametric analyses of the MHD program, and special analyses and support work. Planned FY 1981 work also includes systems projects in conjunction with utilities and engineering services in support of international activities.

5. Supporting Research: The support activity funded here includes work on generators and electrodes together with investigations for high magnetic field effects in MHD channels; design of engineering tests of radiant boilers, and seed-slag recovery system; study of seed-slag properties; work on directed MHD-related coal studies; development of special MHD diagnostic techniques; and materials development and analysis.

6. International MHD Program: MHD programs also exist in Japan and Russia. Emphasis is placed on natural gas in Russia and fuel oil in Japan. Although the United States program has used these clean fuels in their research, the United States plans in the near future to switch to coal as MHD feed stock. The Russian program has emphasized the development of large facilities, while the United States program has developed components. The joint program has permitted the U.S. to test 5 Tesla superconducting magnets at the Russian MHD pilot plant, and a United States 250 MW channel was also scheduled to be tested there during FY 1980. However, after the Russian invasion of Afghanistan, shipment of the channel was postponed and it is now in storage in Illinois.

Committee Views

The Committee feels that prompt testing of the United States 250 MW channel is an important milestone for the MHD program. It therefore urges the Department to promptly evaluate the possibility of testing the channel at the Arnold Engineering Development Center and to determine what modifications and costs that testing would require.

Committee Actions

The Committee disagrees strongly with the President's revised request which cut $1 million for the closed cycle MHD program. The Committee has long supported this effort and feels this subprogram is making valuable contributions to the MHD program; the Committee retained funds for the program.

2. OIL AND GAS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request	Committee action	
				Changes to original authorization request	Total authorization
OPERATING EXPENSES					0
Enhanced oil recovery	22, 600	18, 800		+5, 000	23, 800
Oil shale	27, 000	35, 048			35, 048
Drilling offshore technology	3, 000	2, 000			2, 000
Advanced process technology	5, 500	4, 500			4, 500
Enhanced gas recovery	34, 910	30, 048			30, 04
Subtotal, operating expenses	93, 010	90, 396		+5, 000	95, 396
Program direction	1, 057	1, 213			1, 213
Subtotal	94, 067	91, 609			96, 609
CAPITAL EQUIPMENT					
Enhanced oil recovery	500	600			600
Oil shale	1, 200	1, 000			1, 000
Drilling and offshore technology	0	370			370
Advanced process technology	500	500			500
Enhanced gas recovery	400	500			500
Subtotal	2, 600	2, 970			2, 970
Total authorization	96, 667	94, 579		+5, 000	99, 579

(a) ENHANCED OIL RECOVERY

Program Description

The goal of the Enhanced Oil Recovery (EOR) activity is to develop the technology necessary to increase the Nation's recovery of domestic petroleum. This program can increase domestic petroleum production by developing more efficient recovery technologies, by enlarging the resource target for enhanced recovery, and by accelerating the development of improved technologies and making all related unit costs of oil production can be reduced, and the new technologies are potentially exportable to such areas as Venezuela, where large oil deposits requiring enhanced techniques exist.

The EOR Activity was significantly redirected in FY 1980 as a result of the amended ERA pricing regulations. The amendment will allow oil producers to sell oil currently under price controls at market prices, with the incremental profit being applied to an approved EOR project. The upper limits on this rule are 75 percent of the project expenses, and up to a total of $20 million per project. It is expected that as many as 100 EOR projects may be stimulated by the rule, so that direct funding of new EOR pilots and demonstrations can be limited. However, the responsibility for monitoring these projects and analyzing and disseminating the data still lives within the EOR program, although funding for these activities has not been provided.

During FY 1979, the Enhanced Oil Recovery program was restructured from a process oriented format (micellar polymer flooding, thermal flooding, CO_2 injection, steam drive) to a resource oriented format (light oil, heavy oil, tar sands). Within this structure, the two main objectives of the program are (1) to assess the potential for EOR from the three resources; and (2) to develop the technology needed to make enhanced recovery of these resources technically and economically feasible.

In the FY 1981 budget request, no direct funding is included for field pilot tests or commercial demonstrations. It is anticipated that these types of projects will be undertaken by private industry because of ERA pricing incentives. Small field experiments will continue, however, as an essential part of the R&D program which allows problems to be detected and identifies areas where additional R&D is needed.

Major FY 1981 activities are indicated by resource category:

1. *Heavy oil.*—Two main activities are being pursued: (1) university research and a field test of additive assisted steam drive method; (2) Prototype construction and initial field testing of two downhole steam generators in Project Deepstream.
2. *Light Oil.*—This activity is being deemphasized in FY 1981. Some in-house research at Bartlesville Energy Technology Center will be retained but most of the university research program would be phased out;

3. Tar Sands.—The first tar sand steam drive field experiment will be completed and analyzed in FY 1981; An expanded resource assessment and reservoir characterization effort will be continued; Research into sand control, fracturing, surface extraction processes, and novel concepts will continue.

Committee Action

The Committee increased operating expenses by $5 million; $3 million is provided for data collection and analysis activity for the "incentives" projects and $2 million is provided for the continuation of basic and applied research on micellar polymer recovery technology.

The major reason for the large decrease in the enhanced oil recovery program from FY '79 to FY '81 (from $45 million to $19 million) is that DOE is depending on the ERA "incentives" projects to develop acceptance of enhanced oil recovery techniques instead of using direct DOE funded field projects. However, there are virtually no funds in the FY 1981 budget for DOE to collect, analyze and disseminate the information from these "incentives" projects. The Committee feels that in the enhanced oil recovery area, this is one of the most important contributions for the Department to make in the near term.

The funding for light oil recovery in FY '81 is one half the 1980 level and one quarter the 1979 level. The Committee recognizes the appropriateness of a decrease in this area given the private sector investment in this kind of recovery technology. However, though the oil majors are involved in developing technology for light oil recovery, 85% of the domestic wells are drilled by independents, who do not have the capability of developing new technology. One of the most promising of the light oil recovery technologies is micellar polymer flooding, but the chemicals used in this technology must be individually tailored for each reservoir. Those oil majors involved in developing micellar polymer flooding are inclined to develop chemicals for their own reservoirs. This leaves general characterization and design of micellar chemicals in a vacuum and puts independent drillers at a disadvantage. The $2 million increase in this area is intended to support basic and applied research, that would have been curtailed as a result of the low budget level in FY 1981.

(b) OIL SHALE

Program Description

The near-term objective of the oil shale activity is to provide the technology base for initial commercial implementation by 1985 based on first-generation process concepts that have progressed to pilot stages of development. This objective will be promoted by focusing research and development on critical technology problems associated with process development efforts in active cooperation with industry.

The longer-term objective is to provide substantial improvements in the economics and environmental acceptability of shale oil and gas recovery through research on advanced surface and in situ process concepts that show promise of significant breakthroughs in energy efficiency, resource recovery, and/or reduced environmental emissions and residuals. The program is divided into two subactivities:

1. In-situ conversion

This effort consists of a technology base activity and major field tests. The technology base activities that will receive the most attention in FY 1981 are improved control of rock breakage (fracturing) to give desired particle size and void distributions, optimization of retorting process parameters and control techniques to obtain high yields of shale oil at faster retorting rates, and retort abandonment procedures that will minimize potential for contamination of aquifers at an acceptable control cost.

This work is accomplished in-house at the Laramie Energy Technology Center, the National Laboratories and supporting industrial and university laboratories. The work includes applied research in geophysics, mining operations, chemical engineering, environmental sciences and other scientific and engineering disciplines related to oil shale development.

There are three major field tests, which will continue in FY 1981: (1) the Geokinetics Shale Group, (2) the Equity Oil Shale project, and (3) the Occidental Oil Shale project.

1. The Geokinetics Shale Group (GSG) is demonstrating the surface uplift technique for creating enhanced void volume and a rubblized bed for horizontal retorting. The technique is considered applicable to thin-to-medium-thickness shales up to 100 feet of overburden. GSG, during work prior to November 1979 and during the subsequent cost-sharing cooperative agreement phases, prepared a series of 24 retorts of progressively increasing size and increasing depth and thickness, using three different blasting techniques. The largest retorts of this series, which are normally 217 feet wide by 230 feet long by 30 feet thick, will be initiated in FY 1980 and continue in FY 1981. Two more retorts will operate with 45 to 55 feet of overburden compared to the approximately 100 feet at which this technology is expected to be ultimately demonstrated. Up to 15,000 barrels of shale oil should be produced during 1980. Feasibility demonstration

at maximum depth is now expected by DOE during the FY 1981–82 period.

2. The Equity Oil Shale process is an outgrowth of private industry research in the 1960's that tested horizontal retorting with hot gases in the leached zone. This zone contains water that prohibits direct combustion retorting but can be used for steam generation and other process needs, thus eliminating external water requirements. The process also results in a high-Btu off-gas and has reduced overall off-gas handling requirement.

The leached zone oil shale contains a natural honeycomb porous structure created by the dissolution of salts. The zone contains kerogen equivalent to more than one million barrels of shale oil per acre at the project site. If successful, the .7-acre test is expected to produce at least 300,000 barrels over a 2-year period that began in the fall of 1979. The zone contains an estimated total of 550 billion barrels that can only be retorted by an indirect-heat process. This test will be the largest single module test to date.

3. The Occidental Oil Shale, Inc. concept involves partial conventional mining in order to create an enhanced void space for redistribution during the explosive rubbling which occurs before retorting and is applied to impermeable oil shale at least 300 feet thick, followed by direct combustion retorting.

This process was under active development by the contractor prior to DOE (ERDA) involvement in 1977. The original 71% DOE, 29% Occidential cost-shared provisions were negotiated to 52% DOE, 48% Occidential for Phase II in recognition of substantially higher Phase I costs.

Phase II work is expected to require 36 months for completion. Improved data rights and access to the site for separate DOE experiments will result in instrumentation by Sandia Laboratory of Occidental's solely-funded blasting tests in at least four mini-retorts in FY 1980 and utilization of the data for the further improvement of DOE's rubblization models. This data will be used for final design of a two-retort test, the ignition phase of which is scheduled for late FY 1981.

2. Surface conversion

Principal projects underway in FY 1980 and FY 1981 will be supported by FY 1979 funds. These include cost-shared contracts for engineering design of commercial-scale surface retort modules based on processes that have been well-demonstrated at pilot scale, and an advanced process concept using the Institute of Gas Technology Hytort process that will be tested in a small pilot retort. Contracts to be awarded in FY 1980 for commercial designs will be site-specific for particular western (Green River Formation) locations, while the IGT process is potentially applicable to both eastern and western shales. The FY 1981 budget request includes funds for adaption and application of static-bed computer process models developed for in situ processing to the dynamic-bed conditions of surface retrofitting processes. These funds will also provide for DOE's continued monitoring. None of the projects expected to be active under DOE's FY 1980–81 program are duplicative of projects that industry has previously announced plans to proceed with on the basis of financial incentives alone, but this program combined with such incentives could result in additional commercial-process demonstrations prior to 1990.

Committee Action

No change.

(c) DRILLING AND OFFSHORE TECHNOLOGY

Program Description

The goal of the Drilling and Offshore Technology activity is to develop more efficient technology that will accelerate the pace at which both conventional and unconventional oil and gas are produced both onshore and offshore. The drilling research activity will concentrate on improving conventional drilling systems through generic research and by developing new drilling concepts designed to increase penetration rates, thus permitting an increase in the average footage drilled per rig year. The offshore research activity will attempt to accelerate oil and gas production from the outer continental shelf by developing instruments and by collecting environmental data to support industrial engineering design work for drilling and production in watery depths greater than 1000 ft. and under extreme environmental conditions (e.g., Arctic seas).

The Committee on Science and Technology first showed interest in drilling and offshore technology in FY 1978, when it held a series of hearings. The Committee then authorized DOE to provide the necessary incentive to restart work in specific areas of drilling technology which held real promise but which had been ignored by industry. Industry then became interested in a number of projects, including (1) the joint Industry/DOE program to complete development and to demonstrate a system to measure and telemeter directional data from a bed while drilling, (2) a joint Industry/DOE project to demonstrate a downhole electric motor for improved efficiency in drilling, work on attaching synthetic diamond cutting elements, and (3) a metallization technique for experimental work. In FY 1979, instead of authorizing additional R&D funds, the Science Committee authorized a $1 million drilling R&D management plan which would outline a 5-year drilling program; the Appropriations Committee made a similar request.

In FY 1980, the program will continue laboratory evaluation and field testing in synthetic diamond bits and the pressure core barrel, evaluate and test an inertial guidance system for precision directional drilling, design and do component testing on the water jet drilling system, evaluate new high-strength, corrosion resistant elastomers and alloys, continue field testing of a prototype seafloor earthquake measuring system, and continue to cooperate with the USGS in collecting and analyzing geotechnical data required for engineering design of offshore drilling and production structure.

In the FY 1981 budget, the program faces a 25% cut-back, primarily in the drilling and environmental and support areas. The basic plan is to continue existing work at a reduced level.

Committee Action

No change.

(d) ADVANCED PROCESS TECHNOLOGY

Program Description

The overall objectives of the Advanced Process Technology program are exploratory research in: advanced process concepts, petroleum product characterization, and advanced upgrading and refining processes for oil shale and heavy petroleum. The advanced exploratory research program will pursue two major thrusts: (1) basic technology development, which includes rock mechanics and fragmentation, instrumentation, geological engineering, extraction systems analysis, and in situ heat and mass transfer and fluid flow (hydrology); and (2) new process concepts for the recovery of conventional hydrocarbons and the retorting of oil shales. The Product Characterization and Utilization element will focus on the analysis and characterization of both light and heavy crude oils, shale oil, and tar sands, including analysis of heavy components and the relationship of asphalt composition to road life. This work will emphasize fuel chemistry and thermodynamics. The Shale Oil Refining and Utilization element will complete studies of refining shale-petroleum blends, with the continued development of new processes for the refining of heavy crude oil, and will determine the physical and chemical nature of the stability and performance of shale oil fuel products, as well as develop the technology to remove heavy metals and nitrogen with minimum hydrogen consumption.

In the past the program started research projects for finding microbe strains that can survive in in situ conditions while stripping oil from the formation rock, determine the technical feasibility of retorting oil shale with solar energy, and computerize the crude oil data bank. The program also determines that deep hydrotreating reduces the potential for adverse health effects from chemicals in crude shale oil.

This year's program will involve increased emphasis on the novel concepts program for the development of in situ processes utilizing micro-organisms for fossil fuel extraction and for advanced shale oil retorting including solar, microwave radio frequency in vacuum retorting. On the other hand, the shale oil refining and utilization budget is reduced significantly. This program is designed to reduce refining costs by decreasing the amount of heavy bottoms and low Btu gas produced from the distillation process The product characterization and utilization function which includes oil spill identification, characterizing heavy components of petroleum, determining quality of crude oils and products, storage stability of products, and refining process technology will be level funded for FY 1981.

Committee Action

No change.

(e) ENHANCED GAS RECOVERY

Program Description

Natural gas supplies approximately 25 percent of the total energy used in this country. Current proven natural gas reserves amount to approximately a ten-year supply at the current consumption rate. The bulk of these proven reserves is found in conventional reservoirs which are generally located in the Gulf Coast and southwest regions of the United States. These reservoirs have been developed because they can be easily produced, they have high recovery efficiencies, and they provide acceptable profit incentive.

There are 4 large, unconventional gas resources that are not being fully exploited because our knowledge of the character of these resources and of the technology necessary to recover them are limited. They are (1) the gas bearing Devonian shales of the Eastern United States; (2) the low permeability (tight) gas sandstones of the Rocky Mountain region; (3) the free methane (natural gas) present within coal seams; and (4) the high pressure methane saturated salt water aquifers of the Gulf Coast region (geopressured methane).

Federal R&D for the first three resources is a responsibility of the DOE Fossil Energy program. The geopressured methane resources are included under the Department's geothermal program, since the Department also feels that the thermal energy which is extracted along with the methane is an important recovery resource.

The Federal role is one of complementing industry effort in those R&D efforts required to achieve full exploitation of domestic resources. The specific objectives of the enhanced gas recovery program are to:

(1) characterize thoroughly (physically and chemically) and quantify the resource potential of the unconventional gas resources;

(2) develop cost effective recovery technology, and thereby increase both annual production rates and recoverable reserves attributed to unconventional gas resources by developing cost-effective recovery technology;

and

(3) transfer technical, economic, and environmental data to industry, thereby accelerating commercial development.

The enhanced gas recovery program is generally more highly regarded by the Congress than by the Administrative branch. Once again this year, the President's fiscal year 1981 request is a significant decrease from the fiscal year 1980 appropriation level. Each of the three programs this year is decreased in funding level either by a net reduction in funds or the necessity of picking up environmental and support costs in its budget for the first time or both.

The Eastern gas shales project is a coordinated, multi-discipline effort directed toward increasing natural gas production from the Devonian shales underlying Appalachia, Illinois and the Michigan

Basin of the Eastern United States. The USGS is cooperating with the Department of Energy in a 5-year multi-discipline research effort to characterize the resource. Major industry is also conducting cost-shared field experiments to test various stimulation techniques. Successful conclusion of the research activities included in this program could result in incremental gas production of up to half a trillion cubic feet by 1985. During fiscal year 1981, the following efforts are planned:

(1) Completion of the geological mapping of the Michigan Basin;

(2) Performance of well stimulation tests in two provinces of the Appalachian Basin and selection of well sites in two others;

(3) the drilling and testing of wells in the Illinois Basin;

(4) completion of an assessment of foam fracturing for stimulation of Devonian shells;

(5) development of various mathematical models and predictive capabilities related to the resource.

The Western gas sands project is concentrated in Colorado, Utah, Montana, North Dakota, and Texas. In areas where production is likely, after the more easily produced blanket formations are developed, if technical problems can be solved. Before commercial development can be contemplated, there is a need for adequate reservoir diagnostic tools, appropriate data for effective and efficient well bore fracture designs, and development of controls and cost effective well bore techniques. U.S.G.S. is also doing most of the resource characterization work for Western tight sands under an interagency agreement and industry is involved in field demonstration.

In FY 1981 the following efforts are planned:

(1) Initiation of a stimulation testing program for the first multi-test well;

(2) continued resource assessment, development of improved fracturing fluids and diagnostic tools, and modeling analyses;

(3) development of various mathematical models;

(4) identification of environmental regulations and restrictions related to drilling stimulation and production including the determination of cost of compliance with these regulations;

(5) the conducting of sensitivity studies to update estimates of gas in place and technically and economically recoverable gas.

The methane from coal beds program, which began in FY 1979, will be aimed at the development of integrated methane from coal bed extraction and utilization systems, as well as an assessment of the impact of extraction techniques on future coal mining operations. An integrated project plan document and procurement plan has been prepared.

In Fiscal Year 1981, the following efforts are planned:

(1) a test to develop the capability for using coal bed gas for power generation;

(2) a test to determine the optimum well spacing for methane drainage and to determine its suitability for process heat generation;

(3) a test to determine the effective extraction techniques for recovery of methane from deep coal beds;

(4) various tests to demonstrate different drilling and stimulation techniques in bituminous and anthracite coal;

(5) a test to demonstrate the ability to inject coal bed methane into pipeline systems.

Committee Actions

No change.

D. Fossil Energy—Resource Applications Program

FOSSIL ENERGY—RESOURCE APPLICATIONS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
OPERATING EXPENSES					
Coal:					
Coal resource management program	2, 540	5, 173			5, 173
Coal supply development	1, 497	821			821
Loan guarantee program	272	197			197
Oil and gas development:					
Shale oil	3, 458	2, 036			2, 036
Oil and gas development projects	5, 112	6, 309			6, 039
Subtotal	12, 879	14, 542			14, 542
Program direction	966	551			551
Subtotal	13, 845	15, 087			15, 087
CONSTRUCTION					
Authorization	0	0		+3, 100	3, 100
Budget authority	0	0		+3, 100	3, 100
Total authorization		15, 087		+3, 100	18, 187
Total budget authority	13, 845	15, 087		+3, 100	18, 187

[1] Indicates changes to original FY 1981 B/A request.

1. Alternative Fuels Production Program—P.L. 96–126

The Interior and Related Agencies appropriations bill for FY 1980, Public Law 96–126, provided $2.208 billion for alternative fuels production to establish major synthetic fuel production initiatives. This program has been assigned to the Assistant Secretary for Resource Applications within the Department of Energy. This appropriation provided for funding of cooperative agreements, feasibility studies, loan guarantees, price and purchase guarantees, and administrative expenses. Activities in FY 1981 following on this appropriation will include preparation of the required environmental impact statements for the first high Btu gasification facility, assistance award to impacted states, local communities, and Indian tribes, and development of data evaluations and the results of the feasibility studies.

2. Coal Resource Management Program

This activity, which was called coal utilization last year, will represent the second year of the Resource Applications program to make developing coal technologies commercially acceptable as a replacement for imported oil. The major components for FY 1981 will be a new high Btu gas commercialization program and a continuation of the direct combustion program.

The objective of the high Btu gas commercialization program is to develop the capability in the United States to produce significant quantities of pipeline gas from domestic coal resources and to pave the way for 12 operating plants sited in Western United States by the year 1990. The FY 1981 program will do the necessary, preliminary work to permit the signing of a loan guarantee agreement for the construction of a commercial site plant which would be issued on the basis of competition among various applicants.

The direct combustion program will involve both industrial and utility components. The industrial commercialization program will focus on encouraging the use of fluidized bed combustion and coal-oil mixtures. The major FY 1981 activities will be the updating and expansion of the coal prediction model to extend its use to the estimation of steam costs for various mature plants, the development of a planning guide to provide information on costs, reliability in licensing of fluidized bed combustion and competing coal-fired systems, and a reliability assurance model to predict reliability of coal combustion systems.

In the utility area, emphasis will be on the rapid acceptance of advanced electric generation technologies, including atmospheric fluidized bed combustion in integrated gasifier combined cycle. The major activities will be siting analyses and the development of a model to predict reliability of these plants as compared to conventional plants. The coal resource management program, which conducts market surveys and public information activities to encourage the substitution of coal or coal-oil mixtures in boilers, will be continued in FY 1981.

Coal Supply

The Office of Coal Supply Development is responsible for the development and execution of programs which will effectively increase the production and utilization of coal. Its activities include a coal advocacy program called Coal Use Stimulation, a tracking system for permits and licenses, an activity to implement the recommendations of the Department's anthracite task force, and an environmental support activity to provide ombudsmen for the resolution of environmental issues affecting coal related facility operation or new construction siting.

3. SHALE OIL DEVELOPMENT PROGRAM

Fiscal Year 1981 will be the second year when Resource Applications shares shale oil technology with the Assistant Secretary for Fossil Energy. The two subprograms of this program are shale oil commercialization and shale reserves development.

Shale Oil Commercialization

Commercialization of shale oil is a high national priority because of the huge size of the resource. 400 billion barrels are recoverable eventually if existing technology can be perfected and development is permitted. The program now has established a goal of 400,000 barrels per day of oil shale production by 1990. The program has an oil shale industrialization plan which relies primarily on industry to act in its own interest in response to government incentives. In addition, the program works with the Department of Interior to seek solutions to land issues which restrain industry's ability to produce oil from shale

The requested funding is directed at assistance to Western shale oil states for handling of socio-economic problems of shale development, at expedition of the regulatory permitting process, and for spent shale revegetation demonstrations. Assistance to Eastern states, economic analyses, market analysis and market testing of co-products of shale are also to be conducted. The shale reserves development activity continues the implementation of the congressionally approved shale reserves predevelopment plan which calls for inventorying the physical, biological and environmental characteristics of the shale reserves in Colorado, and to screen and analyze technology suitable to develop the reserves. The FY 1981 program will involve environmental baseline measurement, including work on hydrology, meteorology, air quality measurements, biological resources, geological hazards, fracture surveys and pipeline corridor analysis. There also will be technology work, including trade-off analyses of conceptual designs, pipeline corridors, and mine access/development.

4. OIL AND GAS DEVELOPMENT PROJECTS

The Department of Energy's Resource Applications activities in oil and gas development include an enhanced oil recovery program, an unconventional gas development program, and a supply initiative program.

The enhanced oil recovery program in FY 1981 will continue to work toward the goal of achieving optimum levels of domestic crude oil production through enhanced oil recovery techniques. Areas considered in FY 1981 will include the following studies and initiatives: modification of crude oil price regulations and profits tax to induce massive EOR fields application, determination of the impediments to tertiary recovery caused by multiple ownership in oil fields, the analysis of alternate tax interpretations on certain EOR expenditures.

The unconventional gas recovery program in Resource Applications looked at all four unconventional gas sources that are being developed in the fossil energy and geothermal programs. Studies and initiatives to be funded in fiscal year 1981 include workshops for state personnel, grants for site specific resource assessments, completion of an American Public Gas Association project emphasizing local community applications for gas resources from coal bed methane and Devonian shale and attempts to obtain Federal rulemaking from pursuant to implementation of the Fuel Use Act and the Natural Gas Policy Act.

The supply initiative program includes projects to increase production of domestic oil and gas, including from marginal sources, to accelerate exploration, to establish refinery capacity policy, and to demonstrate and develop tar sands and heavy oil resources. A study will be conducted in all these areas.

Committee action

The Committee increased construction funds by $3,100,000 for a peat-fueled combustion demonstration project.

Peat is an enormous energy resource for this country. There are 1400 quads in the United States; 700 quads in the lower 48 and 700 quads in Alaska. The utilization of peat in a direct combustion mode would permit otherwise fuel-poor states and/or regions to reduce their current dependence on oil and gas. In addition to the peat gasification and resource characterization work currently undertaken by the Department of Energy, the addition of a direct peat combustion project will serve to encourage the use of peat as a regional fuel.

The Committee's increase will permit the initial design and engineering for the demonstration project.

Of the appropriated funds available in the Energy Security Reserve established under Public Law 96–126, the Committee authorized up to $30,000,000 for projects to demonstrate heavy oil upgrading technology. The Committee has, in general, felt that refining technology has been effectively developed by the private sector and does not favor government involvement in advancing refining technology. However, preparing the nation's heavy oil resources for refining presents a number of special problems: (1) the readily recoverable resource is in California, which poses stringent environmental restrictions for both recovery and subsequent upgrading and (2) the recovered crude cannot be immediately processed by most refineries because of excessive concentrations of sulfur and heavy metals. The rapid development of environmentally acceptable technology to upgrade heavy oil to suitable refinery feedstock is an important part of our national energy supply strategy. The Committee does not wish to discourage the private sector role and feels that any federal assistance to develop this technology should be a small share of the total costs. Thus, the Committee felt it was appropriate to extend the coverage provided by the Alternate Fuels Production program appropriated in Public Law 96–126 to heavy oil upgrading projects. The Committee expects the Department of Energy to act promptly to implement this extension and provide for competitive solicitations to determine worthy projects.

E. Energy Conservation

1. BUILDINGS AND COMMUNITY SYSTEMS

BUILDINGS AND COMMUNITY SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [2]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Building systems	17,350	[1] 17,050		+19,000	36,050
Community systems	16,550	15,550		+2,000	17,550
Urban waste	13,000	10,100		+10,000	20,100
Technology and consumer products	29,600	22,040			22,040
Analysis and technology transfer	5,400	5,900		+11,000	16,900
Subtotal, operating expenses	81,900	70,640		+42,000	112,640
Program direction	5,137	6,120		+800	6,920
Subtotal	87,037	76,760		+42,800	119,560
Capital equipment	1,000	1,750			1,750
Total authorization	88,037	78,510		+42,800	121,310

[1] $2,515,000 transferred to "hybrid buildings" program in solar applications.

[2] Indicates changes to original FY 1981 B/A request.

The goal of the Buildings and Community Systems (BCS) program is to improve energy efficiency in buildings, building components, appliances, Federal facilities, and community systems. Specific objectives of the program are to:

Reduce the consumption of scarce fuels (oil, gas) in new buildings by 435,000 BDOE by 1985 and by 2,650,000 BDOE by 2000 over 1975 consumption;

Reduce the consumption of scarce fuels in existing buildings by 1,140,000 BDOE by 1985 and by 1,910,000 BDOE by 2000 over 1975;

Decrease the consumption of scarce fuel resources in the built environment by 5000 BDOE by 1985 and by 1,500,000 BDOE by 2000, through the use of community systems which allow for the direct substitution of waste heat for scarce fuels;

Decrease the consumption of scarce fuels an additional 130,000 BDOE by 1985 and 750,000 BDOE by 2000 through the recovery of energy from municipal wastes.

To meet these objectives, the Office of Buildings and Community Systems—

Performs applied research, development, demonstration, and commercialization activities related to the built environment, including building envelopes, building systems components, space heating and air conditioning systems.

Develops and promulgates energy efficiency standards for new buildings, retrofit buildings, appliances and consumer products.

Performs applied research, development and demonstration of integrated energy-conserving technologies and planning methodologies for communities including district heating systems, integrated community energy systems, site and neighborhood design plans and community energy management plans.

Performs development, demonstrations and commercialization activities for biological and combustion systems to convert municipal waste into fuels.

BCS is a balanced and complementary program encompassing R&D, performance standards, regulatory development, information transfer, and the demonstration of new technologies in the near, mid and long term. It is composed of four principal programmatic thrusts.

Buildings.—This program works with the buildings industry to undertake activities necessary to develop and commercialize energy efficient materials, systems, and standards for new and retrofit buildings. Activities include testing and demonstrating of energy flows in buildings (subprogram: Building systems) and RD&D dealing with residential and business energy tax credits, energy audits, and loan financing (Subprogram: Residential Conservation Service).

Community Systems.—This program undertakes activities to determine which community development patterns are most adaptable to energy conservation and the use of integrated energy systems. The program also evaluates the relationships between energy-use and community design (Subprogram: Community Systems). Activities also include the development of the technology and institutions necessary to convert urban waste (solid and liquid) to a renewable energy source (Subprogram: Urban Waste). This thrust also encompasses energy conservation techniques and guidebooks for small businesses (Sub program: Small Business).

Consumer Products.—This program pursues technological opportunities for improved energy performance of consumer products (oil/gas fired heating equipment, lighting and windows, heat pumps) and the development and commercialization of new technologies (Subprogram: Technology and Consumer Products). Furthermore, this thrust is aimed at developing minimum energy efficiency standards and test procedures for major household appliances, as well as demonstrating innovative methods of encouraging consumers to purchase energy efficient products and to adopt energy efficient practices (Subprogram: Appliance Standards).

Analysis and Technology Transfer.—This program provides the transition from RD&D to market/commercialization for buildings and community systems technologies in the private and Federal sectors (Subprogram: Federal Energy Management Program)/ Activities provide for overall economic and legislative analysis, program evaluation and measurement, technology utilization assessments, environmental assessments, the development of overall marketing/commercialization strategies (Subprogram: Analysis and Technology Transfer).

Specific Accomplishments to date include:

Buildings

Developed, implemented and promulgated proposed Building Energy Performance Standards (BEPS) for new buildings as mandated by P.L. 94–385.

Twenty-five states have implemented training programs for building officials. The training curriculum was developed through the National Conference on State Building Codes and Standards' "Model Code for Energy Conservation in Buildings."

Proposed Rule for Residential Conservation Service (Title II, NECPA) published.

Community Systems

Seventeen communities completed the first year of effort to prepare a comprehensive community energy management program.

Grid-Connected Integrated Community Energy System (ICES) for the Health Educational Authority of Louisiana (HEAL) in New Orleans, University of Minnesota, Clark University and Trenton in final design.

The 5000 gallon/day ANFLOW sewage treatement pilot plan in Oak Ridge, Tennessee has completed 2 years of operation. Promises 75 percent energy savings in a small scale treatment facility, producing methane rich gas and meeting secondary level effluent standards.

A 50 to 100 ton per day facility for digesting mixed urban waste and sewage sludge to produce methane was completed and operated for 1 year at mesophilic (95) baseline conditions. The plant is expected to produce 400 million cubic feet of methane per year.

Selected 20 cities to begin developmental work to lead to the demonstration of a broad range of urban waste technologies. The cities chosen represent a broad range of sizes and stages of completion of project planning.

Consumer Products

An additional prototype of Stirling/Rankine Heat Pump for residential application was generated in the laboratory to collect data on the unit's efficiency, reliability, serviceability and cost of operation. The 120 ton Rankine Heat Pump demonstration system was fabricated and operated in the laboratory. Testing was initiated on prototype units of the absorption cycle system and Brayton/Rankine 7.5-ton heat pump.

A program to characterize the performance of all commercially available residential oil-fired heating equipment and refit options (tested approximately 200 units) was completed. Also identified prototype equipment with high efficiency potential.

Completed prototype design and evaluation of a high efficiency refrigerator-freezer that is 33 percent more efficient than existing models. A 50-unit consumer-oriented demonstration is underway.

Initiated an oil equipment marketing pilot program in Springfield, Massachusetts, targeted at 50,000 oil heated homes involving 25 dealers in direct marketing; initiated program in Nassau/Suffolk counties of New York involving 50 dealers targeting 175,000 homes, using direct mail marketing techniques. Completed the planning for statewide implementation to follow the pilot demonstration.

Advance Notice of Proposed Rulemaking relating to establishment of standards for nine product categories published.

Test procedures proposed for heat pumps and administrative procedures leading to final rulemaking are underway.

Analysis and Technology Transfer

"Project payback," an innovative test program conducted jointly with retailers and manufacturers to encourage consumers to consider the economic advantages of buying more energy efficient products, was run in six cities.

A demonstration was begun involving four U.S. and two Canadian utilities of an energy usage display meter, which has been installed in hundreds of homes for test purposes. Feedback meters have demonstrated 15 percent electrical savings.

The Federal Government, in its internal operations, saved 44 MBDE since the base year of 1975 relative to the Federal Energy Management Program.

Implementation of the President's Emergency Building Temperature Restrictions Program (thermostat energy conservation requirements—65 winter, 78 summer).

Completed "Low Cost/No Cost" consumer education program in New England—resulted in $69 million in energy saved per year on a $2.6 million Federal investment.

Committee Action

The Committee added $42.8 million to this program in the following areas:

(1) Building Systems: a $19 million buildings conservation demonstration initiative.

(2) Analysis and technology transfer: a $10 million add to restore cuts in conservation marketing; a $1 million add to initiate a program in market research.

(3) Community Systems: a $3 million cut in community planning; a $5 million increase in district heating.

(4) Urban Waste: a $10 million increase for demonstration projects.

(5) Program Direction: an $800,000 increase to provide for added staff to implement the Committee's actions.

Buildings Conservation Demonstration Initiative—Building Systems (+$19 M)

Based on testimony received about the potential for improved energy efficiency in new and existing buildings and the existence of serious gaps in the DOE buildings systems program, the Committee adopted a Buildings Conservation Demonstration Initiative to get the results of DOE research out of the laboratory and into wide-spread practice. This initiative has six parts:

(1) a demonstration program for extremely energy efficient houses and commercial buildings ($3 million);

(2) a demonstration program for sophisticated, instrumented energy audits and retrofit incentives ($4 million);

(3) a program geared at developing the full retrofit conservation potential of commercial and multifamily buildings ($5 million);

(4) a program aimed at educating architects, builders, building code officials and contractors about energy conservation techniques in new buildings ($4 million);

(5) data centers to develop information on conservation potentials and cost effective conservation measures for use in DOE programs ($2 million);

(6) program evaluation ($1 million)

The Committee believes these programs could save the nation 2 millions barrels of oil a day by the year 2000.

Conservation Marketing Activities—Analysis and Technology Transfer (+$10 M)

The Committee increased this area by $10 million in order to expand existing consumer education/awareness programs to a national level.

The Market Development branch of the Office of Conservation and Solar Energy has recently completed a highly successful consumer education program entitled "Low Cost/No Cost." This program involved the distribution of a booklet describing eleven low cost energy saving measures and a flow restrictor for showerheads, to 4.5 million residents of New England. The distribution was accompanied by a paid advertising campaign and strong public awareness support, including press conferences with all six New England governors.

The program was carefully evaluated and proved to be immensely successful. Installation of water flow controllers increased 28 percent, furnace efficiency modifications increased 27 percent, and water heater thermostat setbacks increased 23 percent compared to a control group as a direct result of the program. The Market Development Branch would like to expand this very succesful program. To do that would require $34 million for a nationwide effort and $15 million for a full-scale program targeted at the nine heavily oil consuming states outside New England.

The increase would fund implementation of a modest "Low Cost/No Cost" program in the 9 heavily oil consuming states outside New England. Expensive paid advertising would be reduced in favor of working with local citizen groups to promote implementation of Low Cost/No Cost measures. The subcommittee received testimony about the importance of local information sources in motivating changes in energy consumption behavior. The town of Fitchburg, Mass., has recently implemented a highly effective energy conservation program using door-to-door canvassing by local citizen groups. Hence, this scaled down version of "Low Cost/No Cost" has a high promise of success.

Market Research—Analysis and Technology Transfer (+$1 M)

The objective of the proposed program in market research is to improve the effectiveness of the government's incentive, regulatory and information dissemination programs in the area of energy conservation. The Committee believes that market research can help ensure that incentive programs are optimal in size, regulatory programs do not produce undesired side effects and information reaches the audience for which it is intended. The program would help DOE understand how and why people make energy related decisions: What payback is acceptable on solar and conservation investments? Why do different consumer groups accept different paybacks? What non-economic factors influence the acceptance of novel conservation techniques? Why do identical households use substantially different amounts of energy? What kind of information do people need in making energy conservation decisions and what are the most credible sources?

This initiative gives DOE enough funds to increase its current modest research effort in this area and to prepare a multiyear program plan for this Committee detailing the problems to be studied in future years, proposed budget levels and methodologies for carrying out the research. The Committee is mindful of the findings of the OTA review of conservation and solar programs calling for more research in this area.

Expansion of District Heating Program—Community Systems (+$5.0 M)

District heating using waste heat from electric power plants and cogeneration facilities is widely used in Europe but almost unknown in the United States. This technology offers considerable energy savings—perhaps 4 quads by the year 2000 according to one source—by utilizing otherwise rejected low temperature waste streams or renewable energy sources such as solar total energy or seasonal storage systems.

The current DOE program is limited to funding local teams of implementors, customers, and government agencies to finalize institutional arrangements (financial, regulatory, legal, etc.) for implementation of district heating from baseload and intermediate electric power plants. The committee would like to see the program expanded to include other energy sources such as industrial plants, solid waste facilities, solar and geothermal energy systems, peaking and retired power plants, and to more actively coordinate with other Federal agencies and programs (including HUD, EPA, EDA). $5 million will be provided to fund local implementation teams on a competitive basis.

Reduction of Community Planning Program—Community Systems (−$3.0 M)

The Community Management systems branch has been funding a Comprehensive Community Energy Management Program (CCEMP) involving 17 towns and cities over a four year period. In FY 1981 the CCEMP communities will complete the planning phase and move into implementation. In addition in FY 1981 a local energy grants program will begin in the Office of State and local programs. Also, the Community Management Program intends to begin a new initative in "targeted communities" in FY 1981.

The $3 M reduction defers the implementation phase of CCEMP and the "targeted communities" program until DOE reports to the committee on what has been learned from the CCEMP program, whether it intends to transfer community planning to the Office of State and Local Programs, and, if so, how and when? Funds remaining in the community planning area for FY 1981 should be used to close out the existing CCEMP projects, complete the evaluation of Phase I of the project, disseminate information and techniques to other communities and use the CCEMP experience in structuring the proposed local grants program.

Municipal Waste Reprocessing Demonstrations—Urban Waste (+$10.0 M)

The Committee added $10 million for the Municipal Waste Reprocessing Demonstration Facilities program. This program was established under Title IV of the Department of Energy Authorization Act of 1978—Civilian Applications (Public Law 95-238), and provides for a financial support program for converting municipal waste into fuel and energy intensive products. The Department of Energy is authorized under this program to enter into grants, contracts, price supports and cooperative agreements to foster municipal waste demonstration facilities in cooperation with the Environmental Protection Agency.

During its recent hearings, the Committee has heard much about the need for Federal financial assistance to construct demonstration facilities. In many cases these demonstration facilities will be large and thus expensive; $100 million is a common construction cost figure used for planning purposes. Testimony was received indicating that without assistance, many demonstration projects would not go forward.

The Committee is concerned over the Department's failure to implement this program. The Department is directed to utilize its authority under Title V of Public Law 95-238 to gather the needed information about the technological, economic, environmental, and social costs and benefits associated with the use of municipal waste-to-energy technologies. This information is essential if the Nation is to make full use of this presently underutilized resource.

This additional funding is specifically authorized as a line item in the bill for the construction of municipal waste reprocessing facilities pursuant to Title IV of Public Law 95-238. However, this authorization is not meant as an additional authorization should separate legislation authorizing funding for this program be passed during the 96th Congress. The Committee has long recognized that the Federal government can aid municipalities not only in the research and development of the municipal waste-to-energy facility concept, but also, in the construction of demonstration facilities.

Hybrid Buildings—Buildings Systems

The Committee redirected $2.515 million of funds for Buildings systems to a new line item entitled "Hybrid buildings", see the "Solar applications" section for an explanation of this initiative.

2. INDUSTRIAL ENERGY CONSERVATION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Waste energy reduction	16, 450	19, 800		+11, 500	31, 300
Industrial process efficiency	20, 675	19, 000		+22 000	41, 000
Industrial cogeneration	10, 750	12, 000		+6, 000	18, 000
Implementation and deployment	9, 800	4, 500		+6, 500	11, 000
Applied research eduction plan	0	0		+2, 000	2, 000
Subtotal, operating expenses	57, 675	55, 300		+48, 000	103, 300
Program direction	2, 067	2, 600		+2, 000	4, 600
Subtotal	59, 742	57, 900		+50, 000	107, 900
Capital equipment	500	1, 000			1, 000
Total	60, 242	58, 900		+50, 000	108, 900

Program Description

The basic strategy of the Industrial Energy Conservation program is to sponsor costshared RD&D of selected energy-conservation technologies directed at processes that apply to a wide spectrum of industries and processes which are specific to the most energy-intensive industries. Together with a strong emphasis on engineering development and full-scale demonstration in industrial environments, significant program effort is placed on the identification and transfer of existing but underutilized technologies, processes, and techniques to achieve energy conservation in the industrial sector. Activities are selected on the basis of high energy-saving potential, acceleration of implementation, nonredundancy with efforts of private industry, the degree to which benefits accrue to fragmented industry without research funds, and the degree and appropriateness of cost-sharing. Candidate projects are selected based on extensive analysis of risk, cost and benefit.

The projects for Industrial Energy Conservation RD&D are primarily engineering developments of proven concepts and not basic research. These projects are usually initiated as proposals from the private sector and academia. They are carefully screened and prioritized by an evaluation of cost, energy savings, clear establishment of a Federal role, competitive market penetration analysis, and environmental impact. Only those projects not being pursued by the private sector on its own are considered, and cost-shared contracts are initiated on the most promising activities. Every attempt is made to obtain cost-shared relationships with representative and end-user companies for the demonstrations; with equipment manufacturers having the capacity to supply the market once the project is successful; and with representative trade associations. Having such a cost-shared program provides a vested interest of the elements of the private sector which will ultimately implement the technology. Having industrial "knowns" actually performing and contributing to the project has the effect of accelerating the market penetration once it is successful.

The Industrial Energy Conservation Program consists of four major programmatic thrusts: waste energy reduction; industrial process efficiency, industrial cogeneration and implementation and deployment.

Waste Energy Reduction

This activity is directed at reducing the energy loss through waste energy of industrial/agricultural processes by improvements in equipment and processes that are common to many industries. Activity areas and some typical projects are illustrated in Table 1, below.

TABLE 1.—WASTE ENERGY REDUCTION ACTIVITIES AREAS AND PROJECTS

Activity area	Improved fuel conversion	Improved energy use efficiency	Recovery of waste energy	Reuse of recovered waste energy
Typical projects	Air-fuel ratio control. O_2 enriched combustion. Industrial cogeneration systems.	Fluidized bed waste heat boiler. Reduced waste in glass making.	Waste heat recuperators. Industrial heat pumps. Waste tire reclamation. Remanufacturing.	Conversion of waste polypropylene to oil. Methane from CO. Refuse-derived fuel in cement kilns.

As illustrated in Table 1, specific activities include combustion efficiency improvements, reduced waste, use of waste materials as feedstocks and as fuels, waste heat recovery and effective reuse of recovered waste heat such as in energy-integrated industrial parks.

The total potential savings for the specific activities included in the waste energy reduction category is conservatively estimated as ranging from 6.5 to 9.1 Quads annually by the year 1985.

Industrial Process Efficiency

This activity is directed toward increased energy use efficiency and substitution of abundant fuels for scarce fuels in the processes of the most energy-intensive industries, including steel, aluminum, glass, cement, paper, chemicals, petroleum, textiles, agriculture and food. Activity areas and some typical projects are listed in Table 2, below.

TABLE 2.—INDUSTRIAL PROCESS EFFICIENCY ACTIVITIES AREAS AND TYPICAL PROJECTS

	HIGH TEMPERATURE PROCESSES	LOW TEMPERATURE AND END PRODUCT PROCESSES	AGRICULTURE & FOOD PROCESSES
ACTIVITY AREA:	Steel, Aluminum, Other Non-Ferrous Metals, Stone, Clay and Glass	Chemicals, Petroleum Refining, General Manufacturing, Pulp and Paper, and Textiles	Agricultural Production and Food Preparation
TYPICAL PROJECTS:	• Coal in Aluminum Remelt • Aluminum Cathode Improvement • Direct Reduction Aluminum • Blast Furnace Gasifier • Non-Consumable Anode/Aluminum • Hot Inspection of Steel Ingots	• Improved Crude Distillation • Refinery Monitor • Critical Fluid Extractions • Post Paint Curing • High Efficiency Arc Weld Power Supply • Cold Corrugation • Hyperfiltration/Dyestuffs • Foam Dyeing/Textiles • Hydropyrolysis • Computer Controls in Paper Processes • High Frequency Hand Tools	• Crop Drying Alternates • Fertilizer Improvements • Improved Irrigation • Food Processes • Sugar Processing • Energy-Integrated Farm Systems

The targets within each of the major industries are identified by a Second Law (of thermodynamics) Analysis to identify the high-loss points. Projects are then selected and directed to the high-loss points. The projects within the industrial process efficiency activity are principally process changes, i.e., total change of the process and replacement of the related equipment.

Industrial Cogeneration

Cogeneration of electrical power and process heat in industrial operations is a powerful conservation technique. It has been estimated that the energy saved through additional cogeneration systems could exceed 200,000 BPDE by 1985 and 1,000,000 BPDE by 2000 with only modest market penetration. The total potential for a fully developed market is perhaps 3,000,000 BPDE or greater by 2000.

At present, industrial cogeneration potential is grossly underutilized. Where cogeneration is applied, it is, in general, poorly applied in terms of achieving large energy savings. Systems must be selected which employ efficient prime movers sized to satisfy plant thermal baseload and wherever possible interconnected with the grid.

The long-range objectives of the industrial cogeneration program are to develop optimized inter-industrial/utility cogeneration activities, to minimize the requirement for gas and petroleum fuels, to develop and commercialize improved conversion system technologies, and to generally accelerate the rate of penetration of industrial cogeneration.

To achieve these objectives, the Industrial Cogeneration Program has undertaken a number of activities including the following:

Studies to establish cogeneration targets, to define optimum system configurations and to identify technical and non-technical obstacles to market acceptance.

Design and development of components required to achieve efficient cogeneration with fuel flexibility.

Demonstrations of efficient cogeneration systems configurations.

Promotion of proven concepts and components to expedite commercialization.

Implementation and deployment

The objective of this subprogram is to stimulate expeditious implementation of *new*, as well as *existing* but underutilized, energy conservation technologies and practices by the industrial sector. The activities of the subprogram are highly diverse, although related to the same objective, and include the industrial reporting program established by the Energy Policy and Conservation Act; requirements mandated by the National Energy Act: and the variety of analyses, surveys, seminars, documentation and workshops to achieve accelerated energy conservation by the industrial sector.

During FY 1980, this subprogram supported a variety of activities designed to influence industrial managers directly to reduce energy consumption. These activities included conducting efficiency workshops with emphasis on boiler operations, conducting audits for small and medium size manufacturers from six Energy Analysis and Diagnostic Centers, and producing a wide variety of publications directed at both technical and managerial personnel in industry. New technologies developed by the Office of Industrial Programs were deployed to industry, and performance was analyzed under various conditions. Implementation plans were completed for three industries and started for six others. This subprogram also included management of the industrial energy reporting program; a revised regulation was completed, and industrial recovered materials targets were set. Also, in response to the National Energy Act (NEA), industrial motors and pumps were classified and evaluated, and a report was completed on the possible application of the Second Law of Thermodynamics to conservation programs. Modeling and analytical work in support of program-wide project selection, as well as environmental development planning, is accomplished within this subprogram.

Committee action

The Committee increased the industrial energy conservation program by $50 million, bringing the total authorization for FY 1981 to $108,900,000. This authorization is intended to include any such sums as are authorized for Industrial Energy Conservation Research and Development under S. 932 should that bill become law. The increase consists of the following elements:

	Million
Waste Energy Reduction	$11.5
Industrial Process Efficiency	$22
Industrial Cogeneration	$6
Implementation and Deployment	$6.5
Applied Research Education Plan (New initiative)	$2
Program Direction	$2

Waste Energy Reduction (+$11.5 M)

The Committee increased funding in this area by $11.5 million for a total of $31.3 million in FY '81. The Committee intends that the increase be shared between the Waste Energy Reduction and Alternative Materials Utilization branches of the Waste Energy Reduction subprogram.

In the Waste Energy Reduction area, the increase would permit the program to initiate research in tribology (decreased friction), a chemical heat pump that converts low-temperature waste water into low-grade industrial steam, and a bi-phase concentrator driven by low-grade waste heat for concentrating liquids in the food and paper industries. In the Alternative Materials Utilization area, the increase would permit the scale-up of the program's laboratory work in converting cellulosic materials to middle distillate-quality fuel and will permit full funding of the program's first commercial demonstration of advanced technology for refining used lubricating oils.

Industrial Process Efficiency (+$22 M)

The Committee increased funding for this program by $22 million for a total of $42 million. This increase would restore the $12.6 million cut from the Department's budget by the President.

The increase would also permit expanded programs in efficient steelmaking, would keep on schedule the program in computerized papermaking, and would initiate new programs in nitrogen-based fertilizer production, advanced reduction of magnesium and advanced ore extraction.

In the Committee's view, the Office of Industrial Programs has significant expertise in energy conservation processes which could lead to more efficient production of alcohol fuels. The Committee believes, however, that programs undertaken in this area should be conducted cooperatively with the biomass program and the Office of Alcohol Fuels at DOE, should not duplicate projects under those offices' purview, and should be funded by the biomass program or the Office of Alcohol Fuels.

Industrial cogeneration (+$6 M)

The Committee increased this program by $6 million for a total budget of $18 million in FY 1981. The increase would go to two areas identified as worthwhile by DOE: to accelerate the demonstration schedule for an externally-fired gas turbine system that can use coal, oil or gas and to double the number of demonstrations of bottoming cycle waste heat power generation systems. Neither of these technologies is commercially available or proven acceptable to the industrial market.

Implementation and deployment (+$6.5 M)

The Committee increased this program by $6.5 million for a total of $11 million in FY 1981. This increase includes $5 million to expand the program's extremely successful Energy Analysis and Diagnostic Centers (EADC's) and $1.5 million to continue boiler maintenance workshops.

DOE currently sponsors three EADC's—at Georgia Tech and at the Universities of Pittsburgh and Tennessee. The Centers train professors and students to conduct energy audits for small and medium-sized industries and to recommend energy conservation measures along with estimated costs and energy savings. The program has operated for three years on a pilot basis. The $5 million increase would permit expansion from the six centers contemplated in the Department's $660,000 budget request to a total of 50 centers in FY 1981.

With the expansion to 50 centers, DOE projects that energy savings could total over 2 trillion Btu's per year. Additional benefits include training for hundreds of engineering students in energy management and the development of energy management curricula in schools of engineering.

During FY 1980 DOE conducted and completed 10 workshops on efficient boiler operation for New England industries. The workshops were attended by over 200 individuals. The one-day seminars are intended to educate plant personnel about efficient boiler operation, possible process changes and heat recovery methods. DOE projects that the workshops will reduce oil consumption by about 10 percent for participating firms.

In FY 1980, the program's ten workshops were funded at $310,000. No money has been earmarked for workshops in the FY 1981 budget request. The recommended $1.5 million increase would expand the New England effort to fund 40 workshops in several oil-consuming regions.

Applied Research Education Program (+$2 M)

The Committee heard testimony from both the Department of Energy and outside experts that a serious gap exists at the Department between the basic scientific research conducted by the Office of Energy Research and the product development-oriented work conducted by the Office of Industrial Programs.

The Department of Energy responded to the gap between its basic and near-term conservation programs by proposing in the FY 1981 budget a modest new program in Energy Conversion Technology directed at all conservation sectors. Although this is a valuable first step toward bridging the research gap at the Department there remains a serious national problem in the lack of programs in fundamental research and education directed at industrial innovation.

The Committee agrees with the finding of the President's Domestic Policy Review on Industrial Innovation that "the scientific and technologicial strength of American universities has not been harnessed effectively in promoting industrial technological advance." The Committee believes that a strong national program in industrial energy conservation must include two components: the training of graduates in this area and the establishment of strong research programs at educational institutions which can serve the dual purpose of advancing new technology and supporting the knowledge and interest of students and faculty.

The Committee directed the Department of Energy to design a program plan in long-term applied research and education in industrial energy conservation and innovation. The Committee authorized $2 million for this initiative. The plan should be developed in coordination with the National Science Foundation and the Department of Commerce, incorporating the relevant initiatives proposed in the industrial innovation DPR. These initiatives include: The establishment of Generic Technology Centers at universities and other private sector sites and support of high-quality R&D projects proposed jointly by industry-university research teams.

In designing the program, DOE shall consider the following mechanisms: research grants, fellowships to students, teachers and researchers; cooperative programs between industry and educational institutions; and the development of research centers devoted to industrial innovation.

In designing the program for federal aid to research, DOE should emphasize the following goals:

Grants for research should go neither to basic scientific research of the sort conducted by the Office of Basic Energy Research nor to near-term development of the type conducted under the Office of Industrial Programs.

Work under research grants should be determined by the investigator but should use a quality control mechanism such as a peer review with peers drawn from engineering societies, industry and academia;

Federal assistance should be accessible to individuals as well as institutions and research centers.

In designing the program for stimulating education in industrial conservation, DOE shall take into consideration the recommendations submitted to the President by the National Science Foundation and the Department of Education scheduled for July 1, 1980. In addition, DOE shall emphasize the following goals:

Identifying long-term energy and technology manpower needs.

Providing exchanges between industry and educational institutions' students and teachers to keep industrial education up-to-date and to inject innovative ideas into industry.

The program should be designed in cooperation with the science education program plan to be designed by the Department of Education and the National Science Foundation (NSF) under the FY 1981 NSF authorization.

Program Direction (+$2 M)

The Committee added $2 million to the program direction category to cover the increased staffing load expected as a result of the subcommittee's increases in this area.

3. TRANSPORTATION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Vehicle propulsion R.D. & D	59,500	55,400		+5,000	60,400
Electric and hybrid vehicle R.D. & D	41,000	42,100		+3,000	45,100
Alternative fuels utilization	5,200	4,300		+1,000	5,300
Subtotal, operating expenses	150,700	101,800		+9,000	110,800
Program direction	2,923	3,000			3,000
Capital equipment:					
Vehicle propulsion R.D. & D	1,000	500			500
Alternate fuel utilization	100	1,000			1,000
Total	109,723	106,300		+9,000	115,300

[1] Indicates changes to original fiscal year 1981 B/A request.

Program description

U.S. transportation uses more petroleum-derived fuel than all other energy-consuming sectors combined and accounts for over 26 percent of all energy consumed in this country. The transportation sector's almost total dependence on petroleum and the resulting need for imported oil create a major impact on the Nation's balance of payments and result in an already demonstrated vulnerability to petroleum supply disruptions. The goals of the transportation program are to (1) reduce the energy consumed by the transportation sector and (2) reduce, to the maximum practicable extent, transportation's nearly complete dependence on petroleum. The major paths toward this goal are to develop and commercialize alternative transportation and fuel technologies and to promulgate educational and informational approaches to encourage greater efficiency in the use of vehicle and transportation systems. The Office of Transportation Programs seeks solutions to the problems of ever-increasing petroleum consumption and balance of payment deficits and assists the transportation industry by providing transportation technologies, operational strategies and institutional concepts which, when implemented by industry, consumers, businesses, and government will significantly reduce the consumption of petroleum in the United States.

The Office of Transportation Programs FY 1981 budget request for operating expenses and capital equipment is $106,300,000—a $3,423,000 decrease from the budget plan for FY 1980. This amount is required to: (1) research, develop, and demonstrate potential end-use system technologies through Government/industry cooperative projects such that industry can, at the appropriate stage of development, assume the lead role to commercialize the end-use system; (2) develop, demonstrate, and promote innovative operational and institutional practices that will reduce energy utilization; and (3) provide informational, educational, and other outreach programs designed to foster public and business awareness of conservation opportunities. To carry out the program, activities have been defined in the following broad areas:

Vehicle propulsion RD&D;
Alternative fuels utilization; and
Electric and hybrid vehicle RD&D.

Vehicle propulsion R.D. & D.

R.D. & D. effort are underway in accordance with P.L. 95-238 to promote the development of energy efficient propulsion systems for automobiles, trucks, and buses. The primary target of the R. & D. effort is the automobile since it is the largest single petroleum user, consuming more than half of the petroleum used by the entire transportation sector. Many of the technology advances initally directed toward automobiles are expected to also be applicable to trucks and buses, although no major development effort is planned specifically for these two vehicle classes. There are, however, two truck and bus related efforts included in the R.D. & D. program: (1) development and demonstration of waste heat utilization subsystems using the bottoming cycle concept and another version employing turbo-compounding for long-haul diesel trucks and (2) test, evaluation and demonstration of gas turbine powered buses. Major development emphasis in the automobile propulsion program is placed on the gas turbine and the Stirling engine propulsion systems because they offer the potential of significantly improved fuel economy, exceedingly low exhaust emissions, and the capability of using virtually any combustible liquid or gaseous fuel. These propulsion systems are also potentially producible at low cost, and are capable of good performance and high reliability. Research on advanced materials is conducted in parallel with the gas turbine and Stirling engine development programs to accelerate the development of more fuel-efficient versions of these systems. Industry teams are participating under Federal cost-sharing contracts to work on both gas turbine and Stirling engine development.

The FY 1981 request will be used to continue support of two gas turbine development teams and a major contractor to convert ceramic technology into usable gas turbine components. An increased funding level for the Stirling engine development program will permit initiation of some of the Stirling engine commercialization activities to remove market barriers and foster the development of a support infrastructure within the automobile industry. It will also permit increased technology development in heat exchangers, seals and materials. The request will also permit the procurement of two gas turbine buses with advanced ceramic components to enter into revenue service in the city of Baltimore and the continuation of other commercial service demonstrations. Efforts begun in prior years on diesel engine technology development, focused on reduction of exhaust emissions and particulates will also be continued.

Gas turbine.—Two gas turbine system development teams are proceeding in the hardware development program initiated early in FY 1980. These contracts are multi-year efforts leading toward prototype preproduction designs of automobile gas turbine engines that have the potential of improving fuel economy over the conventional internal combustion engine of equal weight and performance (estimated at 10 mpg higher than the 27.5 mpg new car average standard for 1985). The gas turbine development teams reflect a U.S. auto industry commitment towards the development of the gas turbine for advanced transportation systems. Each development team focuses on different turbine concepts (single- and two-shaft versions).

Since the key obstacles to the commercialization of gas turbine automobiles are competitive fuel economy and cost, major emphasis is placed on the development of ceramic materials and on the improved aerodynamic performance of small turbomachinery. Low cost and improved efficiency appear to be simultaneously achievable by utilizing ceramic materials in the hot section of the gas turbine. Major advancements in the durability testing of high temperature ceramic materials in actual vehicle over-the-road testing, components rig testing, and engine dynamometer testing were completed in FY 1979. In FY 1980 durability testing will continue with anticipated substantial improvements in the life and durability characterization of high temperature ceramic materials, fabrication and testing of components for the advanced gas turbine systems being developed by the prime system contractors will continue, and the final designs of the advanced gas turbine system will be completed allowing major hardware procurement to proceed.

The specific activities of the turbine project in FY 1981 are to continue major hardware fabrication leading toward the assembly of the first automobile turbine engine buildups and to initiate component rig and engine dynamometer development tests of compressor and turbines, ceramic parts, and controls. The high temperature ceramic materials project will initiate engine and vehicle durability tests at temperatures 170°F higher than previous tests, complete verification of the ceramic turbine aerodynamic design, and fabricate and test ceramic bladed turbine wheels, ceramic stators and ceramic ducting to confirm the feasibility of using high-temperature, high-speed ceramic rotors and other hot-section parts in gas turbine engines.

Stirling engine.—The Stirling engine project is directed toward commercialization of Stirling engines by the U.S. auto industry by developing technology toward removing economical and institutional barriers. Stirling engines offer potential in fuel efficiency, noise, emissions, alternative fuels, high reliability and low maintainability over a vehicle's life. Technology development is underway with one team to develop two generations of preproduction engines which can be economically feasible to both the producer and consumer. The Stirling engine can be a feasible competitor to the spark ignition and the diesel engine and can provide a more socially acceptable engine for future personal transportation while maximizing the efficiency of the total energy balance consisting of a mix of future petroleum and synthetic fuel supplies. Recent accomplishments in the Stirling engine project include technology transfer aspects of validating baseline engines in a dedicated United States Stirling engine test facility, a design freeze and initiation of component tests for the first generation preproduction Stirling engine (ASE MOD I), and the manufacturing of key components of the engine by U.S. suppliers. Also, key in-vehicle optimization tests and demonstrations of engine compatibility are continuing.

Specific activities of the Stirling engine project for FY 1981 are to take delivery of seven ASE MOD I engines for test and vehicle installation for AMC Spirits and an Oldsmobile FWD Omega, complete the second year of endurance testing of baseline engines, complete combustion rig tests for multi-fuel capability, and initiate some Stirling engine commercialization activities.

Vehicle systems.—The vehicle systems projects are directed toward commercialization of: (1) vehicle subsystems such as transmissions, drivetrains, and accessories which are designed for fuel economy improvements; (2) waste heat utilization systems; and (3) advanced heat engines ready for on-the-road demonstrations. In FY 1980 an assessment of advanced transmissions will be completed and a fleet service evaluation of a controlled speed accessory drive system in actual GSA motor pool operations will be completed. In-vehicle tests for prototypes of both the turbocompound diesel engine and the Rankine bottoming cycle will be accomplished in FY 1980, and the diesel fueled portions of the intercity and urban gas turbine bus demonstration projects will be underway.

In FY 1981 the vehicle systems project will continue activities leading to accelerated commercialization of advanced propulsion systems. Specific objectives are to complete the alternative fuel portions of the intercity and urban gas turbine bus demonstrations; complete the diesel fueled portions of the intercity and urban gas turbine bus demonstration with over 8 million revenue service passenger miles; complete the commercialization plan for the controlled speed accessory drive with industrial pickup of the technology; conduct tests on the turbocompound diesel using advanced turbomachinery; expand on-the-road mini-fleet evaluations of the preproduction Rankine bottoming cycle truck installations; and transfer transmission technology to the Stirling and gas turbine automotive projects.

In addition, capital equipment funds in the amount of $500,000 will be used to procure two gas turbine buses with ceramic components for revenue service.

Electric and hybrid vehicle R. D. & D.

The goal of the electric and hybrid vehicle R.D. & D. program is to promote and accelerate the commercialization of personal and commercial vehicles which use electricity as the principal source of propulsion energy. In accordance with P.L. 94–413 as amended by P.L. 95–238, the program assists in the establishment of an electric and hybrid vehicle industry by conducting research and development, demonstrating economic and technological feasibility, facilitating the removal of barriers and promoting the use of electric and hybrid vehicles. In FY 1981 research and development, product engineering, incentives, and demonstration activities will be continued at levels commensurate with FY 1980 levels.

Demonstrations.—In FY 1978 with 205 electric vehicles, and in FY 1979 with 587 vehicles, the demonstration effort established 11 private sector, 12 Federal agency, 10 State and local government and 12 university demonstration sites on a cost sharing basis. This effort includes vehicle acquisition, test and use of electric vehicles, establishment of in-fleet support infrastructure and provision to manufacturers of the experience data to improve costs, reliability and performance of commercially available electric vehicles. The demonstration identifies tests and proves market sectors where electric vehicles can be used in lieu of petroleum fueled vehicles; it expands the market sectors as vehicle performance and reliability improves as the result of feedback from ongoing demonstrations and as the R&D projects produce better technology. The demonstration also provides the post sales support infrastructure, without which the market cannot grow, and provides cash flow to manufacturers. In FY 1980 500 electric vehicles are being added and up to 19 new demonstration sites. In FY 1981 up to 350 new electric vehicles will be added to existing sites. A small scale demonstration of area service and maintenance will be initiated to aid the industry in insuring proper support for vehicles entering the marketplace.

Product engineering.—Product engineering activities are intended to provide a bridge between R&D and demonstrations by facilitating the introduction of new technology into the marketplace. These activities encompass product evaluation, state-of-the-art assessment, development of performance standards, vehicle testing, vehicle upgrading, and the commercialization of near-term electric vehicle technology.

In the near-term battery area, contracts with eight industrial firms will be continued for development of lead/acid, nickel/iron and nickel/zinc batteries. Research will be continued to improve battery performance; major attention will be focused on increasing the reliability and cycle life of the batteries and lowering the cost. Some of the more promising batteries will be selected for in-vehicle tests. Battery engineering and systems integration will be continued on the three near-term battery types and on a fourth candidate, zinc/chlorine. Cost-shared development of pilot lines for selected battery types will be initiated.

Integration of selected batteries with the electric test vehicles will be continued. Based on the results of in-vehicle and dynamometer tests scheduled to start early in FY 1981, field testing of 5–10 experimental vehicles will be conducted to prove performance and safety of the selected batteries under operational conditions. Field tests of improved propulsion systems developed in the R&D area will also be initiated.

Phase II of the produce improvement activities will be continued in FY 1981 in an effort to upgrade the performance, safety and reliability of vehicles available to the market demonstration. Vehicles will be delivered for acceptance tests late in the fiscal year. A continuing evaluation will be made of progress in the commercial electric vehicle world by vehicle testing and by monitoring market demonstration experiences. Engineering and instrumentation support will be provided to the market demonstration, as required, to help insure successful achievement of the demonstration goals. Performance and safety testing will be conducted to verify manufacturers self-certification to the DOE performance standards. Information resulting from all of these activities will be used as a basis for review of the performance standards as required by P.L. 94-413.

In order to provide guidance for commercialization of near-term electric vehicle technology, a strategy plan will be completed in FY 1981. This will outline the process that DOE will follow to achieve the commercialization goals during the mid-1980's. Actions to track and identify market needs will be continued and commercialization progress will be monitored.

Technology and systems development.—The first two electric test vehicles in the electric and hybrid program were completed in FY 1979 and checkout tests conducted on both a dynamometer and a track in FY 1980; e.g., (1) stop and go driving range at 74 miles; (2) acceleration from 0–30 mph in 8.8 seconds and 25–55 mph in 17.6 seconds; and (3) cruise speed at 55 mph with pass speed at 65 mph. During testing, achievements of the major performance objectives was confirmed. The prime contractor for these first two test vehicles is developing a plan for the commercialization of an electric drivetrain based on the technology developed for these vehicles. Fabrication of a third electric test vehicle (of a more advanced design) was completed in FY 1979 and dynamometer checkout testing is being conducted during FY 1980. These three electric test vehicles, which constitute the near-term electric vehicle program, will be comprehensively tested and evaluated by DOE with completion in FY 1981. The first phase of the near-term hybrid vehicle program, which consisted of mission analyses, design tradeoff studies, and development of preliminary designs, has been completed by the four Phase I contractors. One of the Phase I contractors has been selected to continue with the Phase II effort involving the detailed design and fabrication of complete hybrid test vehicles to be completed in FY 1982. The system selected involves parallel hybrid with fuel-injected spark ignition engine, separately excited motor, advanced lead-acid batteries and microcomputer control. During FY 1981 activities will be concentrated on the upgrading of one or more of the electric test vehicles to assure the availability of high-performance, reliable experimental cars for engineering tests; and the detailed design, development, and fabrication of hybrid test vehicles.

Development of advanced propulsion system components will continue in FY 1981 with the testing of engineering models of advanced motors and controllers. Development of an advanced hybrid propulsion subsystem will be initiated based on designs completed in FY 1980. These efforts offer the potential for significant improvements over existing motors and controllers in terms of higher efficiency, lower weight and lower cost. Concepts are being defined in four parallel design studies due for completion in the second quarter of FY 1980.

Parallel contracts will be awarded for the development of continuously variable transmissions (CVT) suitable for both electric and hybrid vehicles. The successful development of a low cost, efficient CVT is required for the utilization of mechanical energy storage devices in electric and hybrid vehicles. In-vehicle testing and evaluation will be completed for an improved propulsion system that utilizes an efficient transaxle drive with an alternating current motor/controller combination. This system is a primary candidate for commercialization in the mid-1980's. Other activities include development and testing of a prototype environmental control system for electric vehicles that will provide passenger comfort with minimum use of onboard energy.

Incentives.—Six formal applications for loan guaranties and 13 project summaries (the optional preliminary step before filing an application) are being evaluated in FY 1980. Loan application requests through FY 1980 will exceed the guaranty ceiling established by FY 1980 appropriations. During FY 1981 financial assistance in the form of loan guaranties will continue to be provided to the emerging electric and hybrid vehicle industry. Additional funds will be added to the Electric and Hybrid Vehicle Fund to allow coverage of potential defaults of guaranteed loans.

Studies and Support.—This effort includes program evaluation, identification of barriers to commercialization, development of strategies for overcoming these barriers, marketing research, preparation of special reports and annual reports, and program management, applying specifically to electric and hybrid vehicles.

Alternative fuels utilization

The alternative fuels utilization program provides government participation in R&D designed to find the best means of using alternative fuels in highway vehicles from the standpoint of resource/fuel/engine system optimization. The program establishes links involving direct funding between government, automotive, and fuel industries, through which government resources can be used to accelerate fuels-use R&D. The work in this area is aimed at: (1) identifying and resolving major problem areas related to the utilization of alternative fuels and (2) providing broad-based understanding of the practical problems and systems aspects associated with the implementation of alternative fuels in conventional automotive engines. Research activities in FY 1979 concentrated on alcohol and alcohol/gasoline blends in order to bring this fuel option to commercial readiness as soon as practicable. Base-level experiments and assessment of solutions to alcohol use problems through modification of alcohol fuels and engines have been completed, thereby providing the basis for initial specifications of commercial-grade fuels and making it possible to run multi-year reliability fleet tests on alcohol/gasoline blends. In FY 1980 controlled fleet vehicle tests on engineered ethanol/gasoline blends will be completed, as will an assessment of technological options to use nonconventional fuels in critical service vehicles in case of a short-term fuel supply emergency. Conversions of five vehicles for third generation straight-alcohol fuel operation and evaluation using the latest available technology are also scheduled for completion in FY 1980. Potential barriers to the use of these alternative fuels, including environmental, health, safety, distribution and refining constraints are being carefully considered.

The major effort on alcohol fuels will be continued in FY 1981 in order to provide the fuels and automotive industries with data from which to select the best fuel formulations for commercialization and related automotive design requirements for the use of blends and to accelerate commercial readiness of this fuel option. Specific objectives in FY 1981 are to continue development of the technology necessary prior to or in support of extensive reliability tests on alcohol/gasoline blends and on demonstrable fuel/vehicle systems suitable for use of straight alcohol fuels; complete controlled fleet vehicle tests on engineered methanol/gasoline blends; and complete feasibility investigations of the practicality of using ethers from coal that might be used for high concentrations of alcohol/ether blends in gasoline. In parallel with the investigations of alcohol fuels, minor efforts on synfuels and hydrogen already underway will be phased out in FY 1981. Early exploratory work will be completed on (1) converting solvent refined coal (SRC) by-products to usable gasoline extenders and (2) screening tests on hydrocarbon compositional fuel tolerances of internal combustion engines.

$1,000,000 of the FY 1981 budget request are capital equipment funds which will be used to purchase required support equipment and test components/vehicles.

Program direction

The Office of Transportation Programs' research, development, and demonstration budget has grown over the past four fiscal years from $43.3 million to $93.4 million. Staff allowances in support of this budget have, however, increased by only 25 percent during the same period. In response to this constraint, the Office of Transportation Programs has been a leader in developing a sound decentralize management system. Although program management, including key decision authority and overall direction, is retained by program managers at DOE headquarters, responsibility for project management and implementation of most programs is delegate to project managers at NASA laboratories, DOE laboratories and other agencies or institutions. These project offices are responsible for daily program implementation through accomplishment of specific task objectives within guidelines established by annual operating plans. The relative proportion of headquarters to field personnel varies with the nature of the program. For example, subprograms heavily oriented to research and development will, in general, have a greater proportion of field staff than do subprograms which include as a major responsibility contact with other Government agencies and the public. Programs involved in the management of highly visible operations in the commercial world require a higher proportion of headquarters staff.

The growth of a number of programmatic areas in placing an increased workload on the available staff. As planned, the electric and hybrid vehicle demonstration program is expanding rapidly (200 vehicles funded in FY 1978; 600 in FY 1979; 700 in FY 1980; 350 planned for FY 1981—totalling 1,850 by the end of FY 1981). At the end of FY 1979, 45 highly visible electric vehicle operational contracts and agreements were initiated and managed by the small headquarters staff, including a secretary. The number of public operations increased in FY 1980 and will increase again in FY 1981 to 60 participants. Major R&D efforts in EHV battery and vehicle development are reaching the point where commercialization activities involving close government/industry ties must be started. The Alternative Fuels Utilization subprogram is growing rapidly, in part as a result of increasing public, Administration and Congressional interest in alcohol fuels such as Gasohol. The nature of the Transportation Systems Utilization subprogram require direct participation of DOE personnel and is not amendable to delegation or contracting. For example, the development and maintenance of relationships with other governmental (Federal, State and local) organizations and industry, including staff support to assist the State in achieving their energy saving goals, are central to this subprogram and substitution of non-DOE personnel is not a realistic alternative.

COMMITTEE ACTIONS

DOE requested $101,800,000 for Transportation Operating Expenses. This amount reflects a four percent decline in actual expenditures, without regard to inflation. The Committee feels that this is inconsistent with the preeminence of reducing our dependence on foreign petroleum.

Accordingly, the Committee adds $9,000,000 to the DOE request, bringing the total to $110,800,000. This amount provides for increases in three high priority areas:

1. Vehicle Propulsion Research, Development, and Demonstration—$5 million—The DOE request for Vehicle Propulsion RD&D reflects a decision to proceed with the Stirling Engine program on the basis of a single contractor. The Committee feels this is unwise considering the technical risks involved and the high desirability of maintaining some degree of competition.

   The Committee fully understands the difficulty that a second contractor would have in meeting the goals and deadlines of the Automotive Propulsion Research and Development Act. Accordingly, the Committee recommends that the second contractor concentrate on demonstrating the full potential of an advanced Stirling design.

   In addition, these funds are authorized for the purpose of enhancing current activities aimed at stimulating the eventual commercialization of Stirling technology.

2. Electric and Hybrid Vehicle Research, Development and Demonstration—$3 million—The DOE request for Electric and Hybrid Vehicle RD&D reflects a decision to proceed with the Near-Term Hybrid Vehicle program on the basis of a single contractor. Again the Committee feels this is unwise and shortsighted.

3. Alternate Fuels Utilization—$1 million—As presented to Congress, the fiscal year 1981 activities were heavily biased toward alcohol fuels testing, with activities on synfuels and hydrogen being phased out. This addition will insure that activities in other alternative fuels such as hydrogen and synthetic fuels from coal and oil shale also receive more attention.

COMMITTEE VIEWS

Electric Vehicle Demonstrations

The Committee notes with concern, the lack of progress in placing electric vehicles for demonstration as required by PL 94–413, as amended. The Act calls for a schedule of demonstrations as follows: 200 vehicles in FY 78, 600 in FY 79, 1,700 in FY 80 and 7,500 in FY 81–84. Arrangements for the placement of vehicles are as follows: 205 in FY 78, 587 in FY 79, and 500 (planned) in FY 80. Actual deliveries are even further behind.

The Committee believes that DOE must increase their efforts to meet the requirements of the Act by eliminating administrative delays and by encouraging suppliers to expand their production.

ALTERNATE FUELS UTILIZATION

The Committee in approving increased authorizations for transportation programs intends for the Secretary to see that, among the Department's activities, necessary steps are taken to conduct needed research relating to the use of methane (either natural gas as defined in Section 2(1) of the Natural Gas Policy Act of 1978, gas derived from coal, liquefied natural gas, or any gaseous transportation fuel produced from biomass, waste products, and other renewable resources) as a motor vehicle fuel. The Committee is aware of the particular potential for the use of methane as the fuel for fleet vehicles, the positive impact of the use of these fuels on air quality, and the opportunity for developing usable methane economically from a number of domestically available resources including biomass, coal, and natural gas.

Nonetheless, the Committee recognizes that widespread conversions to methane must necessarily be preceded by expert research and development activities designed to address public concerns, most notably with regard to safety questions. Further impact testing as well as an early assessment of the phenomenon of dynamic mixing and responses thereto should most certainly be pursued by the Department.

In addition, in conducting the activities under the Alternate Fuels Program, the Committee encourages the Department to demonstrate the feasibility and practicality of using synthetic fuels of all kinds in light and heavy duty trucks using modified contemporary and advanced engines. Furthermore, a heavy duty truck demonstration program is also encouraged which will test the capability and near term availability of such advanced truck engines. The Department is also encouraged to explore this area further with private industry and to cooperate with private industry wherever possible.

4. ENERGY MANAGEMENT PARTNERSHIP ACT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Energy Management Partnership Act	0	151, 625	−25, 000	−68, 825	82, 800
Energy policy and conservation grant program	37, 800	0	0	0	0
Energy conservation and production grant program	10, 000	0	0	0	0
Energy extension service	25, 000	0	0	−5, 000	−5, 000
Program direction	0	0	0	0	0
Capital expenses	0	0	0	0	0
Total authorization	72, 800	151, 625	−25, 000	−73, 825	77, 800

[1] Indicates changes to original FY 1981 B/A request.

Program Description

Legislation introducing the EMPA was submitted to the Congress on May 15, 1979 and re-submitted on April 14, 1980. This bill will consolidate the State Energy Conservation and Energy Extension Service programs and assist States and local governments in expanding and coordinating other energy related activities, including emergency planning.

The legislation contains the following principal features:

State energy plan.—A participating State would receive an initial grant for planning activities in addition to assistance for continued activities under existing Federal energy programs pending approval of the State energy plan. The plan would provide a framework in which a State, working with local governments, would develop and implement its own strategies and programs.

Energy emergency planning.—Some of the activities included in such planning are State plans for set-aside of petroleum products and other energy supplies, allocation of fuels in short supply during a period of supply disruption, monitoring of supply and consumption, and developing and implementing other emergency energy measures which are responsive to State needs.

Local Funding.—This legislative proposal was amended to provide a special role and funding for local governments.

Coordination of Federal energy assistance.—EMPA would permit States to consolidate applications for assistance programs administered by the Department of Energy and would provide State flexibility in the use of administration funds under such programs.

State energy conservation programs (Energy Policy and Conservation Grant program; Energy Conservation and Production Grant program)

The State Energy Conservation Programs provide a means by which any State may voluntarily enter into a cooperative effort with the Federal Government to further that State's energy conservation efforts. Under this program, a State may elect to develop and implement a comprehensive energy conservation plan designed to achieve scheduled progress toward a specific energy conservation goal for 1980, with the national goal being a reduction in energy consumption of five percent or more by 1980. The Federal Government, in turn, provides to each participating State both technical assistance and financial support.

These two programs will be folded into the Energy Management Partnership Act in FY 1981.

Energy Extension Service

The national Energy Extension Service (EES) is a Federal/State partnership to give personalized information and technical assistance on energy conservation. States receive grants to work personally with families, owners of small companies and local government officials to help them take practical steps in saving energy and switching to renewable energy sources.

EES grant funds are provided to State energy offices or the State entity designated by the Governor to manage the EES program.

This program is authorized by the National Extension Service Act of 1977 (Title V of P.L. 95–39). The decision to expand the program nationwide is a result of a two-year demonstration in 10 States: Alabama, Connecticut, Michigan, New Mexico, Pennsylvania, Tennessee, Texas, Washington, Wisconsin and Wyoming.

This program will be consolidated with the SECP programs under the Energy Management Partnership Act (EMPA).

Emergency Energy Conservation Act

Title II of the EECA P.L. 96–102, provides for the development of State emergency plans to meet curtailment targets established for specific fuels. A supplemental budget request for $14,027,000 has been requested for FY 1980, which includes $10,000,000 for grants to the States to assist in development/implementation of their plans. Separate grant funds are not requested for 1981 since these activities will be included under the EMPA request.

COMMITTEE ACTION

The Committee decreased the funds requested by the Administration for EMPA activities by $68.825 million. This decrease defers the new initiatives contained in EMPA that are not part of existing programs until the EMPA bill itself comes up for Committee consideration.

The Committee also decreased the funds requested for the Energy Extension Service by $5 million. The purpose of this reduction was to require cost sharing with the States in the EES program. This would be consistent with the framework suggested in the EMPA legislation now under consideration.

5. CONSERVATION MULTI-SECTOR

[In thousands of dollars]

				Committee action	
	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization [1] request	Changes to original authorization request	Total authorization
Operating expenses:					
Appropriate technology	12,000	14,100	....	+6,000	20,100
Invention program	4,200	3,400	....	....	3,400
Energy conversion technology	0	11,000	....	+1,000	12,000
Subtotal, operating expenses	16,200	28,500	....	+7,000	35,500
Program direction	635	700	....	+1,000	1,700
Subtotal	16,835	29,200	....	+8,000	37,200
Capital equipment	0	0	....	0	0
Total authorization	16,835	29,200	....	+8,000	37,200

[1] Indicates changes to original FY 1981 B/A request.

Program Description

The Multi-Sector area is composed by three major programs: the Appropriate Technology Small Grants Program; the Energy-Related Inventions Program; and Energy Conversion Technology.

Appropriate technology

Section 112 of the P.L. 95–39, the ERDA authorization for FY 1977, directed the establishment of the Appropriate Technology Small Grants Program. Grants not to exceed $50,000 may be made to individuals, small businesses, State and local agencies, local nonprofit groups and Indian tribes for the purpose of developing community-based, energy-related technologies and techniques that conserve nonrenewable resources or use renewable resources.

A pilot regional program was implemented in the fall of 1977 and the operational management of the program was decentralized. There were 1120 proposals received in response to the program announcement, and 108 proposals valued at $1.3 million were selected. The Lawrence Berkeley Laboratory and the California Office of Appropriate Technology are monitoring the funded projects to evaluate their energy potential and to identify the steps necessary for their successful commercialization.

The quantity and the quality of proposals submitted, and the intense interest in the program nationwide, resulted in the decision to move to a national program. Therefore, a management evaluation of the pilot program was conducted and used as the basis for the preparation of the national program guidelines. After public comment, those guidelines were published on August 8, 1979.

Solicitations for small grants were announced to all 10 Federal Regions in FY 1979 and 580 grants were issued. Approximately 13,000 proposals were received. An energy impact analysis conducted by Lawrence Berkeley Laboratory indicated that on a representative sample of grants from the Region IX pilot program, the direct energy savings over the lifetime of projects would be over twice the amount of money granted. The dollar value of these lifetime indirect energy savings will approach $100 million or 34.9 trillion Btu.

Completed projects from the Region IX Pilot small-scale energy grants program are being evaluated to determine potential for widespread public acceptance by information dissemination and/or marketing strategies. Abstracts for each project are being developed which will ultimately be utilized to foster commercialization of products or services.

The FY 1981 funding will be utilized: to conduct a third round of proposed solicitation and funding in each of the 10 Regions; to evaluate the FY 1980 project results; commercialize the successful technologies and techniques resulting from the program; and to disseminate information on the project results in the appropriate audiences, e.g., users, community planners, and financial community, etc.

Inventions program

The Energy-Related Inventions Program provides direct support to inventors by evaluating their inventions and helping to develop their products or processes for commercialization. Established by Section 14 of Public Law 93–577, this program pays particular attention to inventions submitted by individual inventors and small companies. Inventions are evaluated by the National Bureau of Standards (NBS), which recommends the most promising proposals to the Department of Energy for support. The decision on the type and amount of support, if any, is based on a review of the inventor's proposal for development, by an appropriate DOE official.

Through November 30, 1979, the NBS has received 12,996 requests for evaluation, and completed action on 12,079 of these. Statistically, it is expected that 1.3 percent of the requests will be recommended to the DOE so that 169 total recommendations are anticipated from those already received by NBS. One hundred twenty-four of these have already been recommended to the DOE. The DOE has awarded 57 grants on contracts, 50 during the last two fiscal years.

During Fiscal Year 1980, the DOE plans on awarding 53 grants at an average amount of $80,000 for a total of $4,200,000.

Energy conversion technology

The primary objective of this effort is to achieve major improvements in energy productivity (utilization efficiency) and alternate resource utilization through advanced technology development. Improved energy conversion components and systems for industrial operations, buildings and transportation will emphasize the efficient use of liquid and gaseous fuels. Activities in the general areas of combustion, controls, materials processing and bio-chemical technologies will be pursued.

COMMITTEE ACTION

Appropriate Technology (+$6 m)

The Subcommittee added $6 million to the DOE FY 1981 request for the Appropriate Technology Small Grants program. The Committee feels that this program has been successful in generating public interest and funding worthwhile innovative projects. A study by Lawrence Berkeley Laboratories of 20 projects in the Region 9 pilot program indicated a direct payback of $2 in energy saved for every dollar of Federal expenditure, and an indirect payback—including a very conservative estimate of potential commercialization of 20 to 1. The Committee is concerned however that the fraction of proposals funded by the program has decreased annually from 10 percent in the pilot program to 4.5 percent last year and 4 percent this year. To prevent further decline, the Committee set the level of project funding at $16 million in FY 1981 which should enable the department to fund 1200 projects or 5 percent of the proposals it will receive. In addition the Committtee intends for the program to keep $4 million in house to develop better information packages, evaluate individual projects and the program as a whole provide technical and commercialization assistance to project leaders and expand its outreach and coordination activities.

Planning, analysis and evaluation (+$2 m)

The OTA report on DOE's solar and conservation programs commissioned by this Committee came out with two very strong findings in this area. To quote from the report:

> C&SE lacks a clear vision of where it is going and how it will get there. Some of the programs are doing as well as might be expected, but there is no coherent theme permeating the entire office and guiding the directions and paces of the various programs. This deficiency is evidently a result of the lack of clear direction from DOE management and the lack of a strong analytic capability within C&SE. C&SE needs to develop the capability to determine what it can accomplish for the country, to make sound policy and program decisions to reach these objectives, and to keep the programs moving steadily toward the goals in the face of pressures to alter course in ways not necessarily in the national interest.
>
> Another major deficiency is inadequate program evaluation. C&SE must have the capability of determining which programs have wandered off course or become irrelevant, and which might be usefully expanded. Evaluation will become crucial to some programs in controlling costs as they reach the demonstration state.

To address this issue, the Committee redirected $2 million to the policy and planning office, $1 million for the comprehensive multiyear program plan for energy conservation research, development and demonstration activities required under Section 122 of the Act and $1 million in program direction for added staff in planning, analysis and evaluation. The Committee is extremely concerned over the Department's failure to develop coherent long-range conservation program plans, and directs the Secretary to submit such a program plan to both Houses of Congress in accordance with the requirements of Section 122.

F. Solar Applications

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Systems development	52, 500	54, 500	−5, 000	+10, 000	64, 500
Market test and commercial applications:					
Buildings	35, 750	19, 515		+5, 500	25, 015
Agricultural and industrial process heat	14, 000	20, 800		+2, 000	22, 800
Photovoltaics	10, 000	35, 200	−15, 000	−15, 000	20, 200
Subtotal, market test and commercial applications	59, 750	75, 515	−15, 000	−7, 500	68, 015
Market development and training	20, 500	39, 500		+7, 000	46, 500
Solar international applications	0	4, 000		0	4, 000
Subtotal, operating expenses	132, 250	173, 515	−20, 000	+9, 500	184, 015
Program direction	2, 341	2, 786			2, 786
Subtotal	134, 591	176, 301	−20, 000	+9, 500	186, 801
Capital equipment	2, 000	2, 000			2, 500
Total	136, 591	178, 801	−20, 000	+9, 500	189, 301

[1] Indicates changes to original fiscal year 1981 B/A request.

Overview

The Department of Energy solar programs are under the jurisdiction of the Assistant Secretary for Conservation and Solar Energy. This is a newly created position which has resulted from the consolidation of the Department's solar programs. Previously the Solar Applications program reported to the Assistant Secretary for Conservation and Solar Applications whereas the Solar Technology programs reported to the Assistant Secretary for Energy Technology. This split in the program resulted in less than optimal coordination and, in some cases, in a lack of communication and cooperation which damaged the overall performance of the solar program. An example of the difficulties was the fact that the Solar Energy Research Institute (SERI) and the Regional Solar Energy Centers (RSEC's) reported to different Assistant Secretaries making coordination extremely difficult. Having all the solar programs responsible to a single Assistant Secretary has resolved these organizational problems.

The Committee expects further consolidation of activities and coordination of programs within the overall Conservation and Solar Energy program. More specific directions to that effect appear below.

The FY 1981 Solar Applications program budget request to the Committee on Science and Technology consists of four subprograms aimed toward a directed research and technology program to reduce the cost of and develop the market for solar energy systems. The subprograms are:

Systems development.—Conducts R&D resulting in technically proven components, designs and systems. Equipment and installation costs are evaluated along with operating costs with the aim of minimizing them. Reliability and performance data are gathered and analyzed via prototype and field testing. The results provide important feedback to the product improvement process. Resource assessment as well as urban and community scale systems planning are included under Systems Development.

Market test and application.—Conducts large-scale market testing and product support activities for technical proven field tested) designs and products. Federal funds, on a cost-sharing basis, are used to assist the private sector; Federal purchases are used to stimulate demand. Both are intended to induce manufacturers to invest in mass-production capacity to reduce per-unit price to the customer.

Market development and training.—Gathers and disseminates information in a format useful to customers and to those who influence the pace of new product development and sales; supports the development of a trained contractor and installer workforce in cooperation with industry; and involves other Federal, State and local agencies and private institutions to remove uncertainty and enhance consumer confdence in new solar products.

Solar international.—This new subprogram supports the export of U.S. solar energy products and services as well as cooperative R&D programs.

1. SYSTEMS DEVELOPMENT

Program Description

The systems development activities are undertaken to develop technically proven components, designs and systems. Improved reliability and performance as well as reduced costs are the goals of this activity.

The systems development activities in the Solar Applications program include the following technologies with their associated mid and long term objectives:

Agricutural and industrial process heat

The goal is to bring into mass production reliable, durable and cost-effective systems capable of producing energy at a cost of $6.00 per million Btu's by 1986. Production capacity goals are for 10 million square feet per year of collectors by 1983 with capacity doubling every succeeding year through 1988. The ultimate goal is the displacement of 2.6 quads of non-renewable energy by the year 2000.

Active heating and cooling

The overall goal of the heating and cooling activity is to achieve a goal equivalent to 2 quads of fossil energy by the year 2000. This goal would be achieved by systems development activities in domestic hot water heating, residential and commercial space heating and residential and commercial cooling systems.

Passive and hybrid heating and cooling

The systems development activities of passive and hybrid heating and cooling would, if DOE goals were met, result in the displacement of 1 quad of nonrenewable energy by the year 2000. This goal would be achieved by the introduction of a range of marketable passive and hybrid solar designs, products and systems for a variety of climates, building types and community systems. By 1985, the programmatic goal is the use of passive and hybrid systems in 12 percent of new building construction.

The budget submitted by DOE for FY 1981 reflects an increased level of effort in the agricultural and industrial process heat area with more emphasis on the development of lower cost collectors, reflective surfaces, trackers and controls.

With the transfer of the data collection activities into the systems development subprogram, less funds will be available for active heating and cooling. Reductions in the effort on passive and hybrid heating and cooling are apparent as well.

Committee Views

The Committee has conducted extensive solar energy oversight and authorization hearings including some concerned specifically with activities in the systems development area. As a result of knowledge gained through this process, the Committee has determined several program areas which deserved further attention with the goal of reducing U.S. dependence on non-renewable resources and giving the consumer the most immediate payback.

The solar pond is a versatile energy technique which has numerous end uses. Ponds can provide low temperature heat, store energy seasonally and even provide the energy for baseload electricity generation. In some circumstances they can function as a total community energy option. According to testimony received by the Committee, experimental work thus far has demonstrated the basic technical feasibility of the concept and has identified the remaining technical problems to be solved. A core research and development program for solar ponds with some field test activities to provide valuable data and experience with working ponds would lead to the earliest commercial use of this technology.

Another area which shows great promise but needs additional systems development work, is that of materials research. According to expert testimony the existing program consisting of basic research in new films and coatings and some selective surface analysis for films could be successfully expanded resulting in significant gains in efficiency and reductions in systems' costs. Additional work on site-built systems could also be extremely valuable.

The Committee also learned of the potential value of product development and improvement for passive solar systems. Reduction of systems' costs by 30 to 50 percent are possible with the development of passive/hybrid off-the-shelf products to be used by builders and designers.

COMMITTEE ACTIONS

The committee took actions in the following Systems Development activities:

Materials Research (+$3 million)

The Committee added $3.0 million to provide design, analysis, development and testing of innovative materials such as solar control films, selective surfaces for windows and walls, selective emitters and radiators, storage materials for building components, thermal insulating materials, transparent insulation, heat mirrors and optical shutters, earth/air heat exchangers and dehumidification/dessicant materials.

Passive Soltr Product Development and Improvement (+$5 million)

The $5.0 million added will provide for development and field testing of design, development, prototype testing, engineering and field testing of 20–30 products. Present funding levels are inadequate to implement testing and test marketing of these products. The goal of the program is reduced cost and improved performance of passive/hybrid products, preassembled and off the shelf. Existing building products could be modified to become more easily integrated into passive systems.

Solar Ponds (+$4 million)

The Committee added $4 million for the development of solar ponds.

Solar Ponds (−$2 million)

$2.0 million was cut from Systems Development due to the Committee's conclusion that this work duplicates existing DOE programs. The

Administration's proposal for an Energy Management Partnership Act, the Comprehensive Community Energy Planning program and other related activities have a similar focus and perform related functions.

2. MARKET TEST AND COMMERCIAL APPLICATIONS

Program Description

The Market Test and Applications subprogram tests products in large-scale market applications in order to evaluate their performance and to determine their acceptability to users. Its activities include the use of federal funds on a cost-shared basis to assist the private sector in penetrating the buildings, industry and utility energy technology markets.

The Department of Energy considers specific accomplishments in market tests and application to date to be:

The design, installation, and monitoring of solar heating and cooling systems in 6,656 residential dwelling units.

The design, installation and monitoring of 274 commercial solar heating and cooling projects.

The design and construction assistance for 400–500 federal building solar projects.

Completion of three cycles for the Federal Photovoltaic Utilization Program funding.

Establishment of the International Solar Commercialization Working Group.

Joint sponsorship of overseas trade shows and export market promotion with the U.S. Department of Commerce.

The Administration's FY 1981 budget request was for $76 million to conduct product support and large-scale market test activities, including $2 million not under this Committee's jurisdiction in the Federal buildings program. Program requests under this element included: $18 million for buildings applications (both active and passive); $20.8 million for agricultural and industrial process heating including wood commercialization activities; and $35.2 million to expand purchases of photovoltaic systems into the international and domestic private sectors.

Buildings.—The $18 million requested for the buildings component is to continue support for previously selected demonstration projects. It also provides the Federal portion of joint public-private market tests of active and passive applications. The intent is to leverage Federal dollars with much greater private-sector funds to assist the early establishment of a solar supply industry infrastructure. Demonstration projects include commercial as well as residential structures.

Agricultural and industrial process heat.—The objective of the agricultural and industrial process heat (A&IPH) program is to develop and demonstrate cost effective and reliable solar technology for applications in industrial process heat and agricultural design and heating operations. The A&IPH activities consist of field tests in promising applications to assess technical and economical performance, the users' interactions with an acceptance of solar systems, and the institutional and marketing requirements.

Approximately 40% of the total energy consumed in the United States each year is used in industry and agriculture. This currently represents about 30 quads/year, of which up to 20 quads are used for industrial process heat applications, such as process water heating, hot air for drying, and the production of process steam. The major share of this energy is derived from fossil fuels. Agricultural production consumes approximately 2 quads/year. Almost one quarter of agricultural consumption is provided by liquified petroleum gas and used for low-temperature heat applications, such as crop drying and heating greenhouses and livestock shelters.

The Domestic Policy Review on Solar Energy has estimated that AIPH systems could displace 2.6 quads in the year 2000. This estimate translates into cumulative solar collector production requirements of 5.9 billion square feet.

The FY 1981 budget request for AIPH is $20.8 million, which is a $6.8 million increase over FY 1980. This level of effort will provide 6 full-scale field tests of low and intermediate temperature Industrial Process Heat applications; an enhanced oil recovery intermediate temperature solar system utilizing 250,000 square feet of tough collectors; several 100,000 square feet industrial process applications of particular interest to the chemical, cement and glass industries; approximately 100 design studies for specific market test projects in a variety of non-Federal process heat applications; demonstration of wood technology applications and a harvest/distribution system at 3 or 4 Federal facilities; a cogeneration system using a solar assisted heat pump for an industrial process heat application; and market testing of low temperature solar collectors for AIPH applications.

Photovoltaics.—The major activity of this Market Test and Commercial Applications subprogram has been the Federal Photovoltaic Utilization Program (FPUP). Other activities have included the development of cost-sharing procedures for financial assistance to private and public photovoltaic systems users as well as system suppliers. Marketing information on early residential applications has also been gathered. Beginning in FY 1981 a modest multi-year photovoltaic systems purchase program will be initiated.

1. Federal Photovoltaic Utilization Program (FPUP)

The Department of Energy act of 1978—Civilian Applications P.L. 95–238, authorized $13 million in FY 1978 to acquire life-cycle cost-effective photovoltaic systems for federal facilities. That program was greatly augmented by the establishment of the Federal Photovoltaic Utilization Programs (FPUP) under Title V, Part 4, of the National Energy Conservation Policy Act (PL 95–619). This act authorized the federal purchase of an additional $98 million of photovoltaic systems for use on federal sites for FY 1979 through FY 1981. The objectives of the FPUP program are; to accelerate the growth of the photovoltaic industry through the procurement of photovoltaic systems for installations; to reduce fossil fuel costs to the government; and to timulate the useof lifecycle costing methods throughout the government.

To date, FPUP has completed 3,150 cost-effective photovoltaic systems in 11 federal departments at a cost of approximately $20 million. Of the $98 million authorized for this program, the only funding the Department has ever requested for it is the $5 million requested for FY 1981 to close out the program. The $25 million that has been previously appropriated for FPUP was all congressionally initiated.

2. Photovoltaic Systems Multi-Year Purchase Strategy

DOE is requesting $30.2 million for FY 1981 to initiate the first segment of a systems procurement program that is planned to continue through FY 1985. This program will constitute the core of the Departments' market development activities that were mandated by PL 95-590 the "Solar Photovoltaic Energy Research Development and Demonstration Act of 1978." DOE has structured this program to encourage development of a supply and delivery infrastructure, as well as to provide support to the photovoltaic industry.

The first phase of this program calls for competitive procurement requests that will be issued to fund several companies or teams to provide a few experimental systems that will undergo engineering field tests. A second phase of competition will then be announced to fund a larger number of the systems which were successful in the first phase. The Phase II system will be cost-shared with the system supplier with the government putting up 75 percent of the cost. The cost shared systems will be market tested in the most advantageous geographic areas. Bidders in both phases will be required to offer a complete package including a marketing plan, prospective private and public sector users for the systems, and arrangements with local utility companies for a grid tie-in if applicable.

The $30.2 million requested for this effort in FY 1981 will enable purchase or commitment to purchase approximately 2.5 megawatts of photovoltaic systems over the next few years. The entire five year effort will purchase approximately 8.3 megawatts of systems. These systems will be used in a variety of applications for international, residential, industrial/commercial, and selected central station markets.

Committee Views

In its authorization hearings the Committee heard testimony arguing for a strong passive solar program. According to the Department of Energy, passive solar is the most cost effective solar technology in the near term. Passive solar systems have the potential to reduce significantly the energy requirements of buildings and communities in virtually every part of the nation over the next few years. Passive solar has the potential to displace the equivalent of one half million barrels of oil per day by the year 2000. If appropriate actions are taken now, the nation could reasonably expect passive solar technology to be integrated into 10 million of the projected 40 million new buildings that will be constructed through 2000. In addition it also appears feasible to retrofit 10 million of the present 70 million buildings with passive solar systems during that same period of time.

Two areas where the Department's program is weak are in passive/hybrid multi-family and commercial buildings. The return on investment of federal funds in these areas can be particularly high, as, for example, 12 per cent of the total U.S. consumption of energy is for heating, cooling and lighting of existing commercial buildings.

While convinced of the value of an aggressive passive/hybrid program, the Committee will require that the Department's program bring together the best of solar and conservation technologies in all its Market Test and Applications buildings programs in order to facilitate the design and demonstration of building with the maximum reduction in consumption of non-renewable energy resources.

COMMITTEE ACTIONS

The Committee decreased the program by $7.5 million; the decrease consists of the following actions:

Solar enhanced oil recovery (+$2 million)

The Committee increased the funding requested for solar industrial process heat (IPH) by $2 million. The Department shall use this increase to initiate a small central receiver solar thermal enhanced oil recovery project in the heavy oil region of California. A recent SERI study on Solar Enhanced Oil Recovery concluded that a small central receiver enhanced oil recovery system is the most economical solar thermal technology that could be used for steam enhanced oil recovery. The I.P.H. program is presently pursuing two systems for this application. The project shall be cost shared with companies operating in the heavy oil region of California.

Photovoltaics (−$15 million)

The Committee took two actions on the photovoltaic market development activity under the Market Test and Commercial Applications program. These actions are:

(1) $10 million increase for the Federal Photovoltaic Utilization program.

(2) $25 million reduction for the proposed first year of the multi-year Photovoltaic Purchase Strategy.

The Committee increased the FY 1981 authorization request for the Federal Photovoltaic Utilization Program by $10 million. This action brings the request for FPUP to a total of $15 million for FY 1981. This restores the $10 million that was cut by the Office of Management and Budget from the original DOE request to OMB.

The $15 million would complete the final year of the three year, $98 million procurement of the photovoltaic systems for use at federal sites. The only funding that DOE has ever requested for FPUP is the FY 1981 request for $5 million to close out the program. The $25 million that has been appropriated to date for FFUP has been congressionally initiated. Though the Administation has never wanted this congressionally mandated purchase program, it is a vital element of the market development effort anticipated by Public Law 95–590. Federal market studies have identified a federal market of 10's of megawatts a year in sales by the end of the 10 year photovoltaic program. The FPUP program itself has identified roughly 9.5 megawatts of life-cycle cost effective applications in the federal sector.

The funding will be used to initiate 100 grid-connected military housing photovoltaic systems which will be important in developing an adequate DOE program for domestic residential photovoltaic systems.

The Committee reduced the authorization request for the first year of the Multi-year Photovoltaic Purchase Strategy by $25 million. The remaining funding will begin limited design and marketing activity. The 8.28 megawatts of photovoltaic systems which the Department had planned to purchase over the next four years is a totally inadequate market development effort for reaching the program's goals.

The Committee is deeply concerned with the manner in which the Department has implemented the 10 year photovoltaic program mandate by Public Law 95–590. This law established a 10 year integrated photovoltaic research, development and demonstration program, contemplated to cost $1.5 billion, in 1978 constant dollars. The legislated program emphasized research and development in the initial years, but its major emphasis was market development demonstrations over the life of the 10 year program.

Contrary to Congressional intent, DOE has organized a program centered on photovoltaic research and development over the entire 10 year period. The program plan calls for $1.26 billion out of the $1.5 billion, to be spent on research and development with nearly $500 million going for advanced material research. With this amount of funding earmarked by the department for R&D, there is only $200 to $300 million available for market development demonstrations.

The Committee directs the Department to prepare and present to the Committee within six months a multi year purchase strategy consistent with market development demonstration effort intended by Congress in Public Law 95–590. The new strategy should be roughly equivalent to the level of market development activity outlined in option four of the DOE report. "Federal Policies to Promote the Widespread Utilization of Photovoltaic Systems," which was manded by section 10 of P.L. 95–590. Option four outlines a program which would reach the legislated price reduction goals in 1988, as well as the administration's own goal of one quad of fuel displacement by 2000. The program described in this option would cost approximately $2.4 billion over ten years, but this is not in 1978 constant dollars and accounts for only a 5 percent annual inflation rate. The Committee expects this strategy to be implemented in the FY 1982 budget.

The Committee took several actions to accelerate the impact of passive/hybrid technologies in the marketplace. $2.5 million was added for design development and field testing of passive/hybrid multifamily buildings and $2.5M for a similar project for commercial passive/hybrid buildings. These activities will include a design competition to be judged by a panel consisting of architecture, design, financial and utility professionals. Construction costs will be shared with the federal share accounting for the incremental cost above that of a conventional structure. The Committee provided $0.5M to conduct an analysis of the relationship between solar and conservation in buildings. The product of this exercise is to be a guidebook suitable for designers, builders and consumers to help them determine the optimal mix among the solar and conservation technologies in buildings. DOE is also directed to report to this Committee, no later than December, 1980, on plans to fully cordinate the solar and conservation buildings activities including a plan to fully integrate these programs.

With this concern over coordination in mind, the committee moved the above new activities plus $5.0M of existing activities and 2.515 million from the Conservation Program to a new Hybrid Building activity in Market Test and Applications .

3. MARKET DEVELOPMENT AND TRAINING

Program Description

The Market Development and Training Program is responsible for gathering information resulting from Systems Development and Market Test and Commercial Applications activities. The information is disseminated in a format useful to customers and those who influence the pace of new product development and sales. This program also provides resources to develop a trained contractor and installer work force by private industry, and links the Department of Energy Solar Applications program with other Federal, state, and local agencies and private institutions. The latter activity is aimed at ensuring that these agencies and institutions do not impede the introduction of solar products into the marketplace but, instead, that they complement and reinforce DOE activities to accelerate solar commercialization.

Areas of program concern include financial incentives, regulatory programs, product standards, certification, and codes.

The major activities planned by DOE for FY 1981 in market development and training include:

Support for the development and consensus-based performance standards and codes to provide consumer assurance and enhance consumer acceptance of new products, with emphasis on solar heating and cooling materials performance, heating and cooling subsystems, solar thermal products, and wood-combustion stoves, furnaces and boilers.

Joint programs with local building authorities, the Federal Housing Administration and utility companies to eliminate institutional barriers and promote solar applications;

Support renewable resource development in programs administered by other public and private agencies (e.g., Government National Mortgage Association financing, Small Business Administration loans, tax credits, and incentives at the state level, Economic Development Administration development);

A significant effort to interest state regulatory commissions and energy offices in photovoltaic and wind machine development; the Wind Field Evaluation Program will make small machines and instrumentation available to all state and territories that wish to participate and provide the local leadership necessary to evaluate regional issues on small wind acceptance.

Information programs to serve the needs of builders, engineers, lenders, homeowners, industrial and utility decisionmakers, government officials, and the general public;

Expanded and accelerated training and certification programs for contractors/installers, and workshops for architects, engineers, and home builders to promote the use of passive/hybrid concepts in the construction industry;

Development of courses for vocational/technical schools, secondary schools, and colleges;

An expanded outreach program to promote consumer awareness of solar energy technologies, particularly passive solar heating and cooling;

Continued development of a comprehensive solar energy information data bases;

Provision of technical, financial, and market services to the solar industry with emphasis on small solar businesses;

An expanded solar utilization economic development and employment program aimed at low income communities and emphasizing low technology applications;

Development of an information program, working through regional solar energy centers, to disseminate data concerning new laws, regulations, and incentives; that could make the use of solar process heat systems more attractive;

Workshops and economic analyses where solar AIPH systems are most competitive;

Identification of training barriers to large-scale production installation and operation;

Through regional solar energy centers, identification and removal of state and local barriers to wide-scale solar use by industry, and evaluation of low-temperature, market-ready applications; and

Development of codes and standards for tracking line focus and point focus collectors.

The Administration budget request for the market development and training area is $39,500,000, a $19,000,000 increase over the amount appropriateed in FY 1980.

Committee Views

The United States can save a substantial amount of energy in the near term by using solar energy to heat buildings and water through the use of well known active and passive solar technology. Passive techniques are also available to cool buildings. But before such savings can be achieved, a greater awareness and knowledge of and improved attitudes toward available solar technologies must be accomplished. Only then will consumers, builders, architects, engineers, owners, lenders and legislators make positive decisions on using solar technology.

Research in the communication and diffusion of innovations indicates that a threshold of knowledge exists among target audiences for new technologies such as active and passive solar energy. This threshold is the point at which 20 to 30 percent of such audiences are informed of the technology. Below this threshold little market penetration is likely to occur. Above the threshold, technology transfer is self perpetuating. In testimony presented to the Committee it was pointed out that only 3 percent of the home builders in the United States are now building *any* passive solar homes. This is with a technology that is acknowledged to be cost-effective now. The government's role in this area is to accelerate the national attainment of a threshold of solar knowledge.

Committee Actions

The Committee added $7.0M to expand the existing DOE solar market development efforts by itensifying information program aim-ing to develop specific markets. The emphasis in these activities will be passive solar with intensive promotional campaigns for passive heating and cooling aimed at builders, designers, and consumers.

The Committee is also concerned about the extent to which the Department's solar and conservation outreach activities have been viewed as part of a comprehensive and integrated solar and conservation program. In this regard, the Committee believes that there is insufficient information at the present time to determine whether the Department has developed the most effective and efficient mix of outreach activities. On numerous occasions the Committee has heard about the potential duplication of effort among these activities. Thus, there is a critical need for additional information to determine whether the existing outreach programs are necessary or unnecessary.

Of particular interest to the Committee is the role of the Regional Solar Energy Centers and their relationship with the other activities of the Department. In order for these centers to act most effectively, their roles must be more clearly defined. In addition, the Committee believes that the relationship of these centers with the Department must be more fully and thoroughly considered.

Because of these concerns, the Committee directs the Secretary to transmit to Congress, within six months after the date of enactment of this Act, a detailed comprehensive program and management plan for the conservation and solar technology transfer programs in the Department of Energy, including the Energy Extension Service, the National Solar Heating and Cooling Information Center, and the Regional Solar Energy Centers. Such plan shall include a detailed description of the roles, division of responsibilities and relationships of such Centers with activities of the Department of Energy, including the Energy Extension Service, the Solar Energy Information Data Bank, and the National Solar Heating and Cooling Information Center. In preparing such plan, the Secretary is required to use inhouse personnel exclusively.

4. INTERNATIONAL SOLAR APPLICATIONS

Program Description

The international program has the principal objective of accelerating solar energy use in the U.S. by (a) increasing U.S. technical capabilities through international technical cooperation and (b) strengthening U.S. industry through increased exports of solar systems. The program is also guided by foreign policy objectives, which include: improved diplomatic relations with specific countries; decreased world dependence on nuclear energy and oil through the accelerating and expanding use of solar energy worldwide and improved balance of trade through the early industrial export of U.S. solar equipment and services. The program consists of a number of multilateral and bilateral agreement activities, which include cooperative research, development and demonstration projects as well as information exchange. The program has also involved a number of overseas market assessment and development studies.

Committee Action

No change.

G. Solar Technology

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Biomass energy systems	53, 500	45, 650		+2, 000	47, 650
Alcohol fuels		12, 100		+5, 000	17, 100
Solar thermal power systems	72, 905	92, 550		+18, 000	110, 550
Photovoltaics	139, 700	133, 000		+9, 000	142, 000
Wind energy	45, 260	77, 900		+1, 000	78, 900
Ocean systems	28, 600	38, 300		+6, 000	44, 300
Solar technology international	0	11, 000		+12, 000	23, 000
Subtotal, operating expenses	339, 965	410, 500		+53, 000	463, 500
Program direction	3, 688	4, 000		0	4, 000
Subtotal	343, 653	414, 500		+53, 000	467, 500
Capital equipment	12, 900	14, 050		0	14, 050
Construction:					
Authorization	81, 435	35, 950	−9, 000	+5, 100	41, 050
Budget authority	81, 435	35, 950	−9, 000	+5, 100	41, 050
Total authorization	437, 988	464, 500	−9, 000	+58, 100	522, 600
Total budget authority	437, 988	464, 500	−9, 000	+58, 100	522, 600

[1] Indicates changes to original FY 1981 B/A request.

1. BIOMASS

Program description

Biomass is renewable organic material such as terrestrial or aquatic vegetation and animal, agricultural, and forestry residues. Biomass can be considered a partially renewable source of energy, because plant life renews itself or adds to its matter. Biomass is only partially renewable, because nutrients and minerals have to be returned to the soil or aquatic environment in order to avoid depletion of these essential elements.

Biomass already contributes nearly 1.5 quads of energy, primarily to the forest products industry which burns mill wastes to produce heat and electricity. The goal of the Biomass Energy Systems program is to contribute an additional 0.5 to 1.5 quads of solar energy per year before the mid 1980's through direct combustion of biomass and from small or farm gas and alcohol biomass conversion systems. A total of 6 to 10 quads of energy from biomass by the year 2000 is possible by development of advanced biochemical and thermochemical conversion technologies and new aquatic and terrestorial plant feedstocks.

The primary objective of the Biomass program is to develop technologies for the production of fuels and chemicals from biomass, in order to reduce the nation's dependence on petroleum and natural gas. More specifically, the objectives are to develop appropriate technologies for increased production of biomass materials and to improve and commercialize technologies for the conversion of biomass into useful fuels and chemicals.

(*1*) *Biomass production systems*

To carry out the program, activities have been defined in the following biomass production areas: Sugar Crops, Herbaceous Crops, Silviculture and Aquatic Biomass.

Sugar Cane and *Sweet Sorghum* alcohol production systems are being investigated at a number of universities and USDA stations. The primary emphasis is on sweet sorghum because it has potential for widespread distribution and cost estimates indicate that ethanol from sweet sorghum could be produced less expensively than from grains.

Herbaceous Crops research is centered around the production of non-woody plants that are easily converted into liquid or gaseous fuels. Current investigations, managed by USDA, include species screening, plant breeding studies and evaluations of row spacing, fertilization, irrigation and frequency of harvest on fields.

Efforts in *Silviculture* farms are aimed at achieveing maximum yields of biomass from intensively planted three plantations. Thirty two plots of from 1–100 acres have been established with promising species such as hybrid poplars, hardwoods and eucalyptus on several sites in Georgia, Hawaii and Wisconsin. The construction and preliminary field test of a mobile harvester through a joint effort of DOE and the Forest Service has been completed. Two regional silviculture farms of 1,000 acres are scheduled for FY 1981. Long range research on latex and hydrocarbons producing trees is being conducted at several universities in the country.

Aquatic Biomass is managed by SERI and is directed at exploring a range of land and ocean based aquatic plants such as water hyacinths, kelp and micro algae. The California Institute of Technology, in conjunction with General Electric, established a quarter acre module off the coast of California and planted it with 100 giant kelp transplants. Although the plants were destroyed during a storm, spores from the plants germinated and juvenile plant growth is being monitored. DOE proposes to continue funding the project in FY 1981. Selected species of seaweeds and freshwater plants are under investigation by researchers at Woods Hole Oceanographic Institute in Ft. Pierce, Florida. Investigation is continuing on growing and harvesting techniques for algae biomass.

(2) *Biomass conversion systems*

The conversion of biomass into gaseous and liquid fuels is supported by the following activities: Direct combustion; alcohol fermentation; thermochemical gasification; thermochemical liquefaction; and anaerobic digestion.

Direct Combustion of wood is expected to have the largest commercial impact on the energy supply in the near term. The program has plans to cooperate with industry to design a 1000 ton/day, 50MW wood fuel electric power generation plant at a site in Lincoln, Maine. Procurement for the project has been completed and negotiations on the contract for design and engineering are in progress in FY 1980. A number of projects on small scale systems and industrial retrofit are being supported in order to prove technical and economic viability. The use of wood stoves in residential dwellings has doubled in the last two years. The program supports efforts to improve safety, efficiency and environmental quality for residential systems.

The *Fermentation* of grains and sugar crops to ethanol is a well known and extensively used technology. In order to meet the Administration's goal of 500 million gallons during 1981, a new Office of Alcohol Fuels in DOE was created in FY 1980. Some of the activities for alcohol production in Biomass energy systems will be transferred to that office in FY 1980 and FY 1981. The program is making an effort to improve existing fermentation systems by improving sugar crop feedstocks, developing new methods of separation of ethanol water mixtures and improving overall process energy efficiencies. The program proposes spending $2.5 million to construct a new commercial size fermentation facility employing the latest technologies. Projects at Purdue University, MIT, Lawrence Berkeley Labs and the University of Arkansas using various acid and enzymatic systems are part of a significant effort to develop systems that will convert cellulose to alcohol. The program is also supporting a PDU at Georgia Institute of Technology which is evaluating various cellulosic feedstocks to alcohol systems and evaluating various byproducts. The U.S. Army as Natick, Massachusetts, in cooperation with DOE, supports a pilot plant enzymatic waste to ethanol project. An enzymatic process at University of Arkansas shows a great deal of promise.

Thermochemical Gasification of biomass to produce a low to medium Btu syngas shows near term promise as a method to retrofit coal and oil fired industrial boilers to renewable fuel supplies. Also of importance is the treatment of syngas with various catalysts leading to important fuels such as methanol or Fischer-Tropsch liquids. A group of seven of the most promising gasification processes have been chosen as the basis for constructing seven PDU's. Three of these units are operational, two are under construction and two will be completed in FY 1980. All will be operational by FY 1981. Funds ($2M) for a gasification LEF were appropriated in FY 1979. Data from the most promising PDU's will be used to support the design of the LEF which will be an engineering prototype and is expected to provide information on system dynamics and scale up auxiliaries.

Thermochemical Liquefaction represents a technology which can convert biomass directly into oil for use as a heating or boiler fuel. Current activities consist of the operation of the wood-to-oil facility at Albany, Oregon which is supported by laboratory and bench scale research at several universities and private companies. Construction of a Process Evaluation Unit has recently been completed at the Lawrence Berkeley Laboratory (LBL), Berkeley, California. This is the first continuous liquefaction unit and uses a newly developed LBL pretreatment techniques which produces a high quality oil and simplifies the oil recovery process.

Anaerobic Digestion, which is a process to convert animal manure and other wastes into methane gas, may provide a substantial amount of fuel energy for individual farms or farm cooperatives and farm areas where livestock operation are concentrated. The nation's first full scale test of the commerical feasibility of the anaerobic digestion of animal manure is being conducted at Bartow, Florida, in an operation capable of handling 25 tons of manure per day. Research at Cornell University determined that low cost digestion for small dairy farms (100 cows) can produce biomass at a cost which is lower than propane and fuel oil. Evaluation of a large digestion system for a 350 cow dairy farm at Monroe, Washington is complete and the system is now commercially operational.

(3) *Research advanced systems*

The program supports a variety of projects on innovative systems which may lead to new biomass production and conversion systems. Efforts on the development of a variety of new plant species such as hydrocarbon-bearing plants, *Euphorbia tirucalli*, are underway at a Lawrence Berkeley Laboratory. Investigations sponsored by SERI have demonstrated the continuous production of hydrogen by blue green algae through biophotolysis. Work at MIT has demonstrated the possibility that certain microbes may be able to ferment lignocellulosic materials in a single step and has also found a mixed culture of two bacteria that convert both five and six carbon sugars to produce alcohol. Purdue University demonstrated a novel technique for separating alcohol from water to produce 200 proof ethanol. The process reduces the energy requirements for distillation by 50–85 percent through absorption of vapor phase water by organic materials.

Committee Views

(1) The Committee commissioned an Advisory Panel on Synthetic Fuels. A portion of their report dealt with the Biomass Energy Sys-

tems. It was very critical about the lack of a program strategy plan and made specific recommendations for the development of specific goals and program plans. Similar criticism and recommendations for compenhensive management plans have been made by OTA and the Inspector General for DOE. The Committee concurs with the importance of a comprehensive plan for Biomass Energy Systems.

(2) The establishment of an independent Office of Alcohol Fuels under the Office of the Assistant Secretary of Conservation and Solar has resulted in substantial changes in the Biomass Energy Systems FY 1980 budget. An agreement has been signed that transfers $21.3M (nearly 40% of the BES budget) to the new Office for RD&D efforts on alcohol fuels. The Committee is concerned that accelerated efforts to develop alcohol fuels for gasohol do not infringe on the development of other equally important biomass technologies.

(3) The Biomass Energy Systems continue to have severe staffing problems in FY 1980. The Committee feels that it is impossible to manage the program with the limited staff in the program. The program has developed a tentative staffing plan which the Committee feels should be implemented at once.

Committee Action

The Committee accepted the Department's authorization request of $48,400,000 for Biomass Research and Development.

The Committee took several actions to redirect funds within biomass research and development:

1. Increased thermochemical gasification by $5 million
2. Increased wood combustion systems by $3 million
3. Decreased silviculture and aquatic biomass by $3 million
4. Decreased innovative conversion systems by $3 million
5. Decreased authorization for the construction of a biomass thermochemical gasification experimental facility by $2 million
6. Provided funding for a Biomass Energy Eystems program plan by up to $3 million

The $5 million increase in thermochemical biomass gasification research development is to restore funds that were cut by DOE. The increases are justified by the potential of biomass gasification for making significant contributions to energy supplies in the near to midterm. Syngas products derived from the process can be used for retrofitting gas and oil boilers to biomass feedstocks or they can be converted to important liquid fuels, such as methanol. The Committee feels that the increased activities should be directed toward improving gasifier efficiencies, investigating new feedstocks such as grasses and legumes, and developing small industrial sized air blown systems.

The Committee increased funding for wood combustion systems by $3 million. The increase will accelerate the development of fast burning residential and industrial furnaces with heat storage and continuous pelletized wood fuel feed. The development of better wood furnaces will improve fuel efficiency, decrease air emissions and improve the safety of the systems.

The Committee decreased the biomass budget by $6 million for Production Systems and Research and Exploratory Development. The intent of the Committee is to reduce the amount of the DOE budget in those areas but still leave the programs with substantial increases. A $3 million decrease was for silviculture and aquatic biomass systems. The remaining $3 million was for innovative conversion systems. The Committee supports these programs but felt the decreases are justified because of the long term high risk nature of the programs.

The Committee decreased $2 million for the construction of a biomass thermochemical experimental facility. The project will be designed according to criteria developed by seven PDU units now which are in various stages of completion. The Committee felt construction would not begin in FY 1981. Additional funding of the project is delayed until FY 1982.

The Committee directed DOE to form and head a team of technical experts, including those from the SERI biomas program, for the purpose of preparing a comprehensive multiyear technical and management plan for the Biomass Energy Systems program and directs the expenditure of up to $3M for the preparation of that plan. The plan, which must be completed by March 1, 1981, should make assessment of various subprogram in BES in order to (a) evaluate market potential for fuels and byproducts; (b) determine technical readiness; (c) identify environmental and soil conservation effects; (d) consider institutional barriers; (e) determine the availability of non-petroleum yield process energy; (f) recommend RD&D activity that would stimulate commercialization; (g) determine regional availability of feedstocks supplies; (h) provide data on the economics of the systems.

The subprograms to be assessed should include biomass conversion technologies such as direct combustion, direct and indirect liquefaction, gasification and anaerobic digestion; as well as feedstock production systems such as silviculture, herbaceous crops, aquatic biomass and innovative crop systems. It should also include assessments of grain and cellulose fermentation programs now part of DOE's Office of Alcohol Fuels. The assessments should be used to develop comprehensive goals and milestones for the various subprograms in order to provide an integrated overall strategy and plan for Biomass Energy Systems.

The Department of Energy has three separate elements of the biomass program in Solar Applications, Solar Technology, and Resource Applications. The Committee is concerned about inadequate intraagency coordination of the program. The plan should provide for appropriate division of responsibility and coordination in a concerted integrated strategy to meet the goals of the program.

The Committee is also concerned about the potential for overlap in the biomass research programs of the Department of Energy and the Department of Agriculture and urges the Department in the preparation of the plan to work towards a clear delineation of research responsibilities between the two agencies. The Committee feels that both Departments can contribute uniquely to the development of biomass as an important energy source and desires that both Departments work to bring their unique strengths to the task while stepping back and avoid duplication and waste by telling the other agency take the lead when appropriate.

The Committee created a separate budget line in the authorization bill for alcohol fuels research, development and demonstration. The funds will be administered by the Office of Alcohol Fuels.

The Committee increased the Department's request for alcohol fuels research, development and demonstration from $12,100,000 to $17,100,000. The increase of $5 million for the Office of Alcohol Fuels is to accelerate development of proof of concept demonstrations on acid or enzymatic processes to convert cellulosic feedstocks to ethanol. Fermentation of cellulosic feedstocks such as grasses and agricultural wastes could improve the yield, energy balance and economics of ethanol production.

2. SOLAR THERMAL

Program description

Solar Thermal Power Systems utilize lenses or mirrors to focus sunlight onto target receivers to produce high temperature heat. This is then converted to electricity or mechanical power in a variety of applications. The program involves phased research and development activities to assist U.S. industry in establishing the technical and cost readiness of mid- and high temperature solar concentrating collector systems as a prerequisite to commercial implementation.

The Solar Thermal Program is structured to provide integrated programs for each of the major concentration approaches (Central and Distributed Receiver Systems), beginning with component-level tests and ending with validation of systems appropriate to early markets. In addition, the Advanced Technology Program provides funding and focus for improvements in concentrator and receiver materials and development of advanced, lower cost thermal subsystems aimed at broadening the market potential of solar thermal systems, once the industrial base is fully established.

The Domestic Policy Review on Solar Energy has estimated that electric generation and industrial heat applications of solar thermal concentrator systems can contribute 3 quads of energy by the year 2000. The potential industrial and utility markets for solar thermal technology constitutes more than half of the Nation's present energy consumption. Promising applications for solar thermal systems include: large central receiver electric applications including repowering of gas—and oil-fired peaking electric generating plants and storage-coupled power plants of intermediate capacity factor; industrial process heat (IPH) systems that may use any of the collector types depending on the application's requirements; remote power systems; total energy systems that provide electricity, process heat, and space heating and cooling to industrial, commercial and residential users, and ultimately, storage-coupled process heat, for high capacity factor utility; fuel, and chemical production applications.

Program strategy

The Solar Thermal Program strategy is to: perform market studies and systems analysis; determine user requirements, cost goals and identify important market applications; develop prototype systems to characterize performance and evaluate technology; perform research and development on critical components and subsystems and advanced technologies; and conduct appropriate second-generation applications experiments and engineering prototypes to establish cost readiness.

Three types of concentrator systems are under active development by the program. These are central receivers, represented by the utility power plant now under construction near Barstow, California; linear concentrators typified by the parabolic trough irrigation pumping system recently placed in operation near Coolidge, Arizona, and the parabolic dish concentrators illustrated by the solar total energy system now under construction at Shenadoah, Georgia. Hemispherical bowl technology, represented by the test module recently deployed at Crosbyton, Texas, is also funded under the linear systems subprogram.

Mid-term goals have been established for the program in order to insure that solar thermal systems will be available that can compete with fossil fuels. The goals are in the range of $1000–$2000/KW for electric installed capacity, $5–$10/MBtu for process heat energy costs and $7–$14 square foot for installed collector costs. Studies by the Solar Energy Research Institute and others have indicated that these costs are achievable with present designs at production rates of 10,000 units/year or greater.

Program activities contained in the request

The FY 1981 budget request for the Solar Thermal Program is $117.5 million, a decrease of $3.5 million from FY 1980. This decrease generally reflects the net effect of a large reduction in spending for central receiver application experiments, substantially offset by increases in the Distributed Receiver and the Advanced Technology Program.

The FY 1981 budget request for the Central Receiver Program is $37.25 million. The central receiver concept was recognized early in the program as being advantageous in penetrating the utility bulk electric market. However, recent studies have identified this system as being cost effective for smaller and lower temperature application, such as steam enhanced oil recovery. The major thrust of the Central Receiver Program in FY 1981 is the completion of the 10 MWe Central Receiver Power Plant in Barstow, California. $10 million is being requested in FY 1981 to complete the project by December 1981.

Studies directed by SERI and completed in FY 1980 confirmed earlier DOE assessments of the repowering application as being an early market opportunity for the central receiver technology. One study by General Motors Corporation found that the heliostat cost goals could be met or exceeded by producing the Barstow heliostat design at a rate of 20,000 units per year. Five second generation low cost heliostat development efforts are underway and will continue through FY 1981.

The principal program thrust in FY 1981 leading to the commercialization of central receiver technology is continued preparation for repowering application experiments. Building on the conceptual design efforts begun in FY 1979, thirteen studies, one privately funded, involving retrofit of industrial and utility facilities are underway and will be completed in FY 1980, with a site solicitation to be issued late in FY 1980. $3 million is requested in FY 1981 to take only one of the thirteen designs through the preliminary design phase.

The Distributed Receiver program request for FY 1981 is $46.25 million, an increase of $12.25 million over FY 1980. This request includes $21.05 million for line focus systems and $25.2 million for point focus systems.

Line Focus Systems are being developed for near term applications in the 150–1000°F temperature range. The types of concentrators being developed include the parabolic trough and the stationary hemispherical bowl. FY 1981 requested funding for trough systems will provide for the continued operation of the deep well 150 KWe irrigation pumping system in Coolidge, Arizona and the addition of improved collectors and the initiation of construction of line-focusing modular repowering experiments. Trough Technology development activities include finalization and evaluation of second generation subsystem and the development of third generation hardware.

The hemispherical bowl development for FY 1981 will include the conceptual design of a larger system and the detailed design of a 200 foot module to be built at Crosbyton, Texas.

Point Focus Systems, typified by the two-axis tracking parabolic dish, are being developed, capable of temperatures from 750°F to 3000°F. Due to this high temperature capability, the dishes can take advantage of very high efficiency heat engines (such as Brayton and Stirling cycle). Dish experiments to be funded in FY 1981 include a 400KWe industrial total energy project in Shenandoah, Georgia and a 1MWe Small Community Experiment at a site to be determined. Experiments focused on remote applications will also be funded in FY 1981 including a 100 KWe modular military power experiment co-funded with the Navy and other isolated local projects.

The Advanced Technology Program request is $34 million, an increase of $12 million over FY 1980. The requested activities include: completion of industries assessment of high performance thin glass and the pilot manufacture of thinner glass, identification of candidate transparent plastics suitable for use as concentrator material; development of cavity and fluid bed receivers to permit materials processing and testing of a receiver capable of pyrolyzing biomass materials atnd continued development of the advanced central receiver and line focus systems components.

Committee action

The Committee increased operating expenses by $18 million and decreased $1.9 million in construction funds. The increase will accelerate efforts in two major areas of the solar thermal program:

(1) central receiver utility/industrial repowering projects ($15 million); and

(2) Stirling, point focusing heat engine development ($3 million).

An increase of $15 million was made for preliminary designs of central receiver utility/industrial repowering projects. During FY 1979, 12 conceptual design contracts were awarded for central receiver solar thermal repowering projects. These designs are for the repowering of industrial boilers and for the repowering of existing utility oil and gas fired plants with central receiver solar thermal systems. The solar thermal program had originally planned to fund eight of these projects through the preliminary design phase, at $3 million per design.

During the Administration's preparation of the budget request, only one preliminary design was funded. The remaining funds were diverted to other solar thermal projects, including the cost overruns for the Barstow Project. The Committee actions restore funds to carry six projects through preliminary design. The result of this action is that $18 million will be available for repowering in FY 1981.

The Committee designated $3 million to develop a second generation Stirling point focus heat engine for use with a parabolic dish solar thermal system. In FY 1980 a steam receiver and a hot air receiver Stirling heat engine are being tested at the Parabolic Dish Test site at Edwards Air Force base. In FY 1981 there is only enough funding for the testing of an open cycle Brayton heat engine, which will be utilized on a joint DOE/Navy parabolic dish solar thermal applications experiment.

The modular nature of the parabolic dish system makes it an ideal application for a high efficiency external heat source engine, such as the Stirling and Brayton. The testing data to date has been insufficient for a determination on which engine (Stirling or Brayton) is the best; therefore, the $3 million will be used to develop the next generation of the Stirling heat engine to improve the data base on this attractive engine option.

The Committee deferred initiation of project 81-T-306, a Solar Thermal Cogeneration Project, until FY 1982. This is a new project added to the program for the first time in the FY 1981 request. This project is similar in scope to the project called for in the unsolicited proposal received last year for Fort Hood. The unsolicited proposal for Fort Hood was withdrawn in December after the budget was close to being completed.

The $1.9 million would have gone for A/E and long lead procurement with no estimate for the total cost of the project. The project would utilize a small central receiver system in an industrial setting. Several of the repowering projects also address the industrial application of central receiver technology so the Committee has deferred this project until FY 1982.

3. PHOTOVOLTAICS RESEARCH AND DEVELOPMENT

Program description

The objective of the Photovoltaic R&D program is to further the rapid development of photovolataic arrays and related equipment, which produce electricity directly from sunlight, and to assure prompt commercial application of these systems in the U.S. and abroad. The intensive research, development and testing activities of the last five years are culminating in sharply declining prices for photovoltaic devices and systems. This, coupled with steadily rising costs for electric power, now promises to make photovoltaics an economically feasible means for the homeowner to produce electricity beginning in the mid-1980's.

A vigorous, broadly based R&D effort is providing new and improved light-sensitive materials and other PV system components. Selective development of the more promising technologies is providing several commercially ready options. Careful attention is being given to automating solar cell production techniques and improving other components in order to reduce system costs.

Modules and systems are being produced for extensive testing in operational settings. Investigations are underway on related factors such as the tie-in of residential systems with utility grids and the growth of maintenance, sales and other service functions. The entire effort is geared to the challenging goals established in the Solar Photovoltaic Energy Research, Development and Demonstration Act of 1978 (PL 95-590).

The Domestic Policy Review for Solar Energy, conducted in 1978, and the National Energy Act have estimated that one quad of the national energy supply may be derived via solar photovoltaic systems by the end of the century. Also the recently completed report to Congress entitled, "Federal Policies to Promote the Widespread Utilization of Photovoltaic Systems" has confirmed these estimates by estimating that more than one quad can be expected from photovoltaics by the year 2000.

Program strategy

The general strategy of the photovoltaic program is to continue supporting advanced research and development on a broad front, while selectively promoting technology development of the more promising materials, components, and devices, in order to assure that a series of reliable systems will begin appearing in the marketplace in the mid-1980's.

The Photovoltaic Program module, systems price goals and primary applications are as follows: (in 1980 constant dollars)

Year	Module prices (f.o.b.) (per peak watt)	System prices (per watt)	Energy prices (cents per kilowatt-hour)	Prime application
1982	$2.80	$6–13	20–50	Remote/international.
1986	.70	1.60–2.20	6–12	Residences.
1900–2000	.15–40	1.10–1.30	4–9	Utilities.

Program accomplishments

The programs broad accomplishments reflect the successful decentralization of contract management and the development of a detailed Multi-Year Program Plan.

Management decentralization has been accomplished through the development of two lead centers in the field. These are located in the Solar Energy Research Institute in Colorado, which directs the Advanced Research and Development effort, and the Jet Propulsion Laboratory in California, which provides field management of the other program elements: Technology Development, Systems Engineering Standards and Test and Applications.

A second general accomplishment involves the planning and associated programming steps looking to ultimate commercialization of PV systems. Achieving more competitive pricing will result in economic viability for photovoltaic energy systems for small stand-alone applications such as irrigation, water pumping, refrigeration and other uses that now rely primarily on diesel generators. Significant market opportunities already exist in developing countries due to the recent steep escalation in fuel oil prices. Other major achievements include:

Advanced Research and Development.—The establishment of a quality research base in Advanced Research and Development—This program element has been expanded from $6 million in 1977 to $50 million requested for 1981. This element has also been the cornerstone around which the Department has implmented PL 95–590. This growth allows about 150 contractors—university, small and minority businesses and larger industrial labs—to develop new solar cells which have very low potential cost and sufficient lifetime in the terrestrial environment. The relatively high efficiency of 9% achieved in thin films of silicon and cadmium sulfide is most encouraging. Major progress in efficiency of complex cells for concentrators is also being made. There is high confidence that the expanded Advanced Research and Development Program will provide the new technology to assure that the difficult long-term goals are met.

Technology development.—This effort is directed to cost reduction in the price of arrays and installed systems sufficient to lead to electricity prices that are competitive with electricity from conventional fuels. During the past year, several techniques for producing inexpensive sheet silicon needed for making photovoltaic cells have reached a high level of maturity and are ready for automation development. These include the ribbon technologies of Mobil Tyco, Westinghouse, IBM and Motorola; the novel sheet development of Honeywell of dipping ceramic substrates in molten silicon; and the development of low cost, low energy process for casting silicon suitable or making good photovoltaic cells. The latter processes have been developed by two small businesses: Solarex and Crystal Systems.

Similar improvements have been shown for concentrator cells and subsystems.

Another significant area of cost reduction is the Balance of Systems program that was initiated in FY 1980. Many contractors are now addressing the cost reductions required for site preparation, array mounting, wiring, power conditioning, distribution costs, and repair and maintenance.

Test and applications.—Experimental projects are under contract for virtually every major application area for photovoltaic systems. The Residential Experiment Stations in Boston and the Southwest will demonstrate a capability that will facilitate easy deployment of photovoltaic systems for residences when economic viability becomes a reality in 1986.

Major experiments dedicated in 1979 include a 60kWe Air Force Radar Station application at Mt. Laguna, California and a daytime AM radio station in Byran, Ohio. The largest photovoltaic system to date, 100kWe, nearing completion at the Natural Bridges National Monument in Utah, will be dedicated early in 1980. Nine additional systems are now under contract or construction. These 20–250 kWe systems costing $20M will provide for the first time hands on experience with modest size systems.

Program activities contained in the request

The Photovoltaic research and development program's FY 1981 budget request is $140 million which reflects a $7 million decrease from FY 1980.

The request for the Advanced Research and Development elements is $50 million, a $3 million increase from FY 1980. This funding will be used to continue investigating advanced cell materials to enable the program over the next several years to select "winners" from the many options in the program and to concentrate funding resources on these options with high probability of meeting our 1990 goal. In the advanced materials and cell research area, there are four contenders for early transfer to Technology Development. Selective advancements will be made from the amorphous silicon, gallium arsenide, cadmium sulfide and polycrystalline silicon technologies. By emphasizing those approaches with the higher probabilities of success, the more promising techniques can be brought to commercial readiness sooner.

The funding will also allow the expansion of the high risk R&D in order to exploit new ideas being generated through the recently initiated innovative concepts project. More than $13 million will be applied to this high risk R&D in order to exploit new ideas being generated through the recently initiated innovative concepts project.

The Technology Development budget request is $60 million, a $1 million decrease from FY 1980. The Technology Development area in FY 1981 will continue to narrow the funding to key areas with virtual certainty of meeting the 1986 goals. The JPL, Low Cost Silicon Array (LSA) flat plat effort will receive $36 million. Many of the continuing efforts in the identification and design of automated concentrator assembly equipment will be coming to fruition in FY 1981. This element will also shift cadmium sulfide systems into production development during the upcoming year.

The request for the Test and Application element is $15 million, a $9.5 million decrease from FY 1980. This reduction is due to the fact that most of the experimental PRDA projects were funded during FY 1980, whereas in FY 1981 most expenses are associated with the completion of construction, operation, maintenance and collection of data. The only new starts in FY 1981 in Test and Applications is the expansion of the residential application experiments, which involve the construction and test operation of experimental units in specially designed residential settings in different parts of the country.

The request for Systems Engineering and Standards is $15 million, a $0.5 million increase from FY 1980. One million dollars will be used for further examination of such things as user preferences and institutional and legal constraints to the use of PV systems. Systems development ($12 million) will include work on prototypes and installation and maintenance techniques, performance criteria and test standards ($2 million) will provide for accreditation and product certification standards, including work with trade organizations.

Committee action

The Committee increased operating expenses by $9 million; this was composed of increases amounting to $15 million and a decrease of $6 million. The increases will accelerate efforts in three major areas of the protovoltaic program:

(1) Balance of Systems research and development ($5 million).

(2) Expand the JPL Low-Cost Silicon Array (LSA) program into the area of low-cost residential photovoltaic array development ($5 million).

(3) Advanced silicon materials processing pilot plant ($5 million).

The $5 million increase for Balance of Systems (BOS) will expand the work underway to reduce the BOS costs. Last year DOE initiated work on reducing the costs of the non-photovoltaic array portion of a photovoltaic system. This (BOS) work was funded at $13 million for FY 1980 and DOE is requesting the same amount for FY 1981. The BOS costs are potentially a very limiting factor to achieving the photovoltaic program's photovoltaic system price goal of $1.60 per peak watt in 1986. The present BOS costs for grid-connected photovoltaic applications are mostly in the range of $10 to $20 per peak watt. DOE's goal is to reduce this to $0.90 per peak watt in 1986.

The General Accounting Office in a letter report submitted to DOE on April 19, 1979 recommended that BOS cost reductions receive a greater emphasis in the DOE program. The Committee's increase will add greater emphasis to this work in FY 1981 and support development of mountings, controls, and inverters for grid-connected applications. It will also fund additional work on BOS costs for photovoltaic systems used in foreign market applications.

The Committee also added $5 million to expand JPL's Low Cost Silicon Array (LSA) project into the area of low-cost residential photovoltaic array development. The Jet Propulsion Laboratory has had the management responsibility for the LSA project since the ERDA Photovoltaic program began in 1975. All of the cost reductions that have occurred in the photovoltaic program have been a direct result of the industrial research and development activity sponsored by the LSA project. Since the grid-connected residential application appears to be the most promising application for photovoltaics over the next decade, it is vital that JPL's expertise be extended and applied to the development of low-cost grid-connected systems.

The Committee provided $5 million to initiate A/E and long lead procurement on a 300 metric ton per year pilot plant for Advanced Silicon Materials Processing. A recent industrial survey by JPL, for DOE, has found that the polycrystalline silicon needed for both semiconductor devices and solar cells will be in short supply from 1982 to 1985.

The needs of the semiconductor industry will probably be met by the existing supply industry, but at much higher prices, $100 per kilogram or higher for polycrystalline material compared to current prices of about $65 per kilogram. The curent 1980 free world supply of silicon material is about 2700 metric tons. The combined demand in 1980 is close to 2200 metric tons, with photovoltaics accounting for about 60 metric tons of this total. By 1981 to 1982, total demand is expected to exceed current supply.

The needs of the growing photovoltaic industry are not likely to be met under current industry plans, i.e., the program's planned price goals of $35 per kilogram in FY 1982 and $14 per kilogram in FY 1986, respectively, will not likely be met. The failure to meet these low-cost goals will be reflected in higher array and systems costs than projected in the current DOE plans in the 1982–85 period.

The $5 million increase will be utilized to fund engineering, design, and development plus long lead hardware procurement for a 300 metric ton per year advanced silicon processing pilot plant. This pilot plant will utilize the best process of those under development that offers significant promise of reaching the program cost reduction goals. The total cost of the pilot plant is estimated to be approximately $25 to $30 million with industrial cost sharing required.

Decreases.—The Committee reduced Advanced Research and Development by $6 million. ($6 million from High Risk R&D).

The Advanced R&D element of the DOE photovoltaic program began to receive increased emphasis in FY 1979 when the Administration increased that part of the program from $4 million in FY 1978 to $33 million in FY 1979. Since then this program has grown to the $50 million being requested for FY 1981.

DOE's multiyear photovoltaic program plan calls for $450 million to be spent on advanced R&D over the life of the 10 year program. This is approximately one-third of the funding that DOE has planned for the total photovoltaic program. The emphasis on advanced R&D has been the cornerstone of DOE's implementation of the Photovoltaic Act. This is contrary to Congressional emphasis on market development.

DOE has produced a report "Federal Policies to Promote the Widespread Utilization of Photovoltaic Systems," which calls the emphasis on advanced R&D into question. The report lays out seven funding options for the photovoltaic program and the effect of each option on attaining program goals. Option 3 most closely matches the present DOE program with a strong emphasis on advanced R&D. That option is estimated to have only 16,000 MW installed by the year 2000. Option

2 with a reduced emphasis on advanced R&D and stronger emphasis on market development will have 29,000 megawatts installed in 2000.

The $6 million reduction reduces the authorization for advanced R&D to $44 million, a $3 million reduction from the amount appropriated for FY 1980. The reduction affects only the high risk R&D effort. This important reduction is a clear indication that the Committee is dissatisfied with the implementation of P.L. 95-590 and has reoriented the photovoltaic program to reflect Congressional intent.

4. WIND

Program Description

The objective of the DOE Wind Program is to accelerate the development of reliable and economically competitive wind energy systems to enable the earliest possible commercialization of wind power. To achieve this objective it will be necessary to advance the technology, develop a sound competitive industrial base, expand user awareness and acceptance, and address those non technical issues that could delay the introduction of new wind machines. Thus the program's primary challenges is the development of economical wind systems capable of providing up to 30 years of reliable, safe, relatively maintenance-free service.

The Domestic Policy Review on Solar Energy has estimated that wind energy can contribute 1.7 quads of energy in the year 2000. This translates into 30,000 to 40,000 large machines (above 1MWe) and one to two million 1-to 10 KWe small machines. This estimated contribution is predicated on a successful research and development program to reduce energy costs and provide reliable machines, resolution of institutional barriers, and availability of appropriate incentives.

Wind Systems are generally classified as horizontal—or vertical—axis machines. Wind systems of three relatively discrete sizes are being explored: small machines of less than 100 kWe for use with light loads such as farms and rural residences: an intermediate size with a nominal 100 to 500 kWe rating for a variety of intermediate load applications; and megawatt-scale (above 1 megawatt) units for larger loads such as utility applications.

Program strategy

The Wind program strategy is to pursue R&D to produce a sequence of machines with increasing performance and lower production unit costs. The specific program costs goals are $.03-.06/kWh for small machines and $.03-.04/kWh for large machines (1980 Dollars). As the cost approaches the levels needed for broad commercializations, demonstrations would be initiated in the early to mid 1980's to familiarize users and support the evolving industry. If needed, the demonstrations would be supplemented with incentives to insure sufficient demand until a self-sustaining industry is in place.

The R&D activities, which are currently the main thrust of the program, recognize that cost effective machines alone are not sufficient to achieve full commercialization of wind systems. This is reflected in the programs structure and the FY 1981 budget request of $80 million, a $16.6 million increase over FY 1980. This request provides funds in four main areas of the program.

Research and analysis, which includes market and economic analyses, impact assessments, environmental assessments, investigations of innovative concepts, FY 1981 request is $7.7 million, a $1 million decrease from FY 1980.

Wind characteristics includes resource assessment, siting methodologies, meteorological research to aid design, and selection and evaluation of candidate sites. The FY 1981 request is $6.2 million, an increase of $0.8 million over FY 1980.

Technology development to provide a technical basis for reduced systems costs and improved performance for both small and large machines. The FY 1981 request is $17.1 million an increase of $4.2 million over FY 1980.

Engineering development producing a sequence of more advanced small and large machines with lower energy costs. The FY 1981 request is $49.0 million an increase of $14.6 million over FY 1980.

Program accomplishments

Some of the recent accomplishments include the completion of the first cycle of small machines development efforts by 9 contractors. During FY 1980 prototype machines of 1.8 and 40 kWe size are being installed at the DOE Rocky Flats Small Systems Test Center for extensive testing. The field evaluation program is underway with machines installed in New Hampshire, Wyoming, Massachusetts and other states. The first wind resource assessment has been completed for the Pacific Northwest region and the resultant Wind Atlas will be released during FY 1980. Similar regional resource assessments are being conducted in parallel during FY 1980.

For the intermediate scale machines, three 200 kWe (MOD–OA) prototype machines are being tested on electric utilities. The MOD–OA at Clayton, N.M. has operated for nearly 6000 hours, delivering in excess of a half-million kilowatt hours of electricity to the municipal utility. Two other utility grid connected MOD–OA's are operating at Culebra, P.R. and Block Island, R.I. and a fourth unit is being installed in Hawaii during FY 1980. In the megawatt scale class, the MOD–1, located at Boone, N.C. is operating on the utility grid. This machine (the largest operating in the world) has reached an output of 1.6 megawatts of electricity, the highest ever produced by a wind machine. The next machine to come on line will be the MOD–2 which is designed to meet a cost of energy goal of 4.5¢/kWh (1980 Dollars) if produced in quality. In FY 1981, a cluster of three MOD–2 machines will be installed at Goodnoe Hills near Goldendale, Washington, making this the first megawatt multi unit wind farm.

Program activities contained in the request

The $7.7 million requested for the Research and Analysis activity will be used as follows:

Market and impact analyses will culminate in late FY 1981 in firmer estimates of market size as a function of wind machine costs in differing applications. Analyses will also be directed toward refining and updating operational requirements in various applications.

The innovative concepts activity includes continued research and investigations into alternative wind system concepts to determine their potential for lower energy costs.

The FY 1981 request for the Wind Characteristics activity is $6.2 million. This request will allow for the completion of a National Wind Atlas by mid FY 1981. It will also provide for special wind resource assessments in areas that appear to have good winds but in which high uncertainty exists because of poor quality or missing data. Also the siting handbooks for large and small machines users will be updated. The requested budget also provides for continued evaluation of candidate test sites and the selection of new sites for evaluation.

The sum of $17.1 million is requested in FY 1981 for Technology Development. This will include development work on components, subsystems and analytical tools needed to provide a basis for increased systems performance at lower cost. The technology development work for small machines is being performed at the DOE Rocky Flats Small Systems Test Center. It includes the testing of commercially available and privately developed small wind machines. The USDA is supporting this effort by conducting applications testing of these machines in various residential and agricultural environments. For the intermediate and megawatt scale machines, the technology development work is conducted by the NASA Lewis Research Center. This work includes the operation of the MOD–O test bed at Plum Brook, Ohio and the extended operational testing of the MOD–OA's at Clayton, N.M. and Culebra, P.R. and the MOD–1 at Boone, N.C. (including the testing of fiberglass blades). Technology development efforts for the vertical-axis Darrieus machine is being conducted at the Sandia Laboratories, including extensive use of the 5 and 17 meter test machines.

The FY 1981 request for engineering development is $49.0 million, for activities in small, intermediate and megawatt scale machines.

For small scale machines the request is $10 million. These funds will provide for the completion of the 4 and 15 kWe machines (each by two contractors), the completion of application testing and product improvement for the 1, 8 and 40 kWe machines (total of 9 contractors), and the initiation of a limited number of second generation machines (2 to 4 contractors at 2 to 20 kWe).

The main emphasis of the intermediate scale development will be the Advanced Multi Purpose, Medium Scale Wind Turbine (MOD–6) with two competitive contractors, one for a horizontal axis machine and one for a vertical axis Darrieus machine. The requested funding for this element of $13.8 million will also provide for completion of the operational testing of the MOD–OA's.

The remaining $25.2 million is requested for megawatt scale systems development. The main emphasis will be the competitive Advanced Multi Megawatt Wind Turbine (MOD–5) development contracts. The MOD–5 will be the last megawatt scale machine developed by DOE. In FY 1981, these development efforts will complete their preliminary and detailed designs which will permit an accurate assessment of the expected cost of energy from the MOD–5's. The funding will also cover the operational testing of the first generation MOD–1 and the three unit MOD–2 wind farm.

Committee action

The Committee added a total of $13 million to the program; $8 million was added in operating expenses; $5 million added in construction funds; and $7 million was transferred from operating expenses to construction funds.

During the first session of the 96th Congress, the Committee spent a great deal of time investigating the DOE Wind Energy Program. H.R. 5892, the "Wind Energy Systems; Research, Development and Demonstration Act," and the programs that it would establish, is the culmination of that effort. The legislation, which passed the House 383–23, and is now before the Senate, authorizes $100 million for Fiscal Year 1981. It establishes three key program elements around which the Wind Program is to be built. The first element is a three year Wind Resource Assessment Program. The second element is a six year, small machine research, development and demonstration program, and the final element is an eight year large machine research, development and demonstration program. The Committee actions that were taken brings the DOE wind program for FY 1981 in line with the activities called for in H.R. 5892. The actions increased the authorization request by a total of $13 million which makes the FY 1981 Wind Program authorization $93 million. The individual increases are as follows:

(1) Wind Resource Assessment ($4.5 million—operating expenses)

(2) Delivery of Product Improved 8 kilowatt and 40 kilowatt small machines ($5 million—operating expenses)

(3) Six additional MOD-5 Advanced Multi Megawatt Wind Turbines ($5 million-construction funds)

The Committee increased the request for Wind Resource Assessment by $4.5 million. This work is of vital importance because of the site specific nature of the wind resource. The economics for wind systems can vary by as much as a factor of two, because of wind velocity differences at a site.

The increase of $4.5 million for Wind Resource Assessment activities brings the amount requested for these activities up to approximately the $10 million authorized in H.R. 5892 for the Wind Resource work authorized in Section 6 of the Act. This increase is made up of two separate actions and they are:

(1) *+1.5 million for a Utility Site Validation Grant Program.*—There is $2 million in the budget request for this work. The addition brings the total available for this activity to $3.5 million. This funding would be used for the establishment of a grant program with utilities for intermediate and large wind turbines site validation. The grants would be $150,000 for a minimum two years of site validation work with utilities situated in promising wind regions.

(2) *+$3.0 million for Site Prospecting for Small Wind Machines.*—There is $1 million in the budget request for this work. The addition brings the total available for this activity to $4.0 million. This funding would be utilized, to make 10 to 15 meter instrumented towers, siting handbooks, and training available to small wind machine distributors or potential distributors on a regional basis. This will help to develop the small wind machine siting expertise in the local distributors of the machines. This will also aid the development of the industrial infrastructure that is needed if the goals of H.R. 5892 are to be reached.

The committee increased the funding for the MOD-5 Advanced Multi Megawatt Wind Turbine effort by $5 million.

The MOD-5's will be the last megawatt scale wind turbine developed by the DOE program. On February 7, 1980, DOE announced the award of parallel contracts for the MOD-5 to General Electric and to Boeing. Each contract is for the development of one prototype MOD-5, with an option, but no commitment, for two additional units. Each contract will be in the range of $15 to 20 million and the prototype is scheduled to be tested in FY 1983.

H.R. 5892 calls for the accelerated development of the MOD-5 by parallel contractors and for the MOD-5 to be the mainstay of the cost shared utility large machine demonstration program. This demonstration program is to begin in FY 1983 with the demonstration of 8 MOD-5's (4 from each contractor). The MOD-5, in production, is estimated to deliver electricity at approximately three-cents per kilowatt-hour.

The $5 million increase for the MOD-5 will go for the commitment for the delivery of three additional units from each contractor in FY 1983. This will be added to the $21.5 million already in the FY 81 budget for MOD-5, bringing the total to $26.5 million. Each additional MOD-5 unit will cost approximately $5 million each. The addition of six units will add $30 million to the MOD-5 program but DOE's share would only be $15 million since the additional units would be cost shared on the basis of 50 percent DOE funding, with the remaining coming from utilities or third parties in combination with either Boeing or General Electric.

Another committee action on the wind program was to increase the funding for product improved small wind machines by $5 million. The DOE small wind machine program has developed six developmental machines in the sizes of 8 kilowatts and 40 kilowatts. The prototypes developed have been delivered to Rocky Flats and USDA for testing and evaluation. The $5 million increase would be utilized for the delivery of product improved versions of the best four machines. Product improved units, 15 per contractor, should be produced and delivered to DOE for an expanded application testing and field evaluation program. Receiving this number of units from each contractor will assist that contractor to get valuable production and production tooling experience with their most advanced machines, as well as have these advanced machines commercially available to the public.

The Department should consider locating a number of these machines on a single utility grid. This would be important to gain valuable data on the interface of a number of small wind machines with a single utility grid.

The committee decreased the request for the innovative concepts effort by $0.5 million leaving $700,000 for this work in FY 1981 and a $1 million reduction for the development of second generation 2-20kwe small wind machines leaving $1 million for this activity.

5. OCEAN SYSTEMS

Program description

The oceans store vast amounts of solar energy, enough energy to make sizable contributions to the energy needs of the U.S., as well as those of other coastal nations. For the United States, four ocean-energy technologies offer significant promise: Ocean Thermal Energy Conversion (OTEC), wave power, ocean currents, and salinity gradients. The DOE program for these four technologies is presented in terms of plans, concept descriptions, projected market penetration, and potential institutional barriers to implementation. The OTEC program presently receives about 95 percent of the total ocean energy systems fund.

The Domestic Policy Review of Solar Energy estimated that 0.1 quads could be obtained annually from OTEC by the year 2000. This projection was based upon early studies, however, and more recent studies by both the Department and Congressional subcommittees have indicated that an annual impact of up to 2.0 quads by the year 2000 is possible, depending on the commercialization strategy employed after an OTEC pilot plant is successfully operated.

Program strategy

The Ocean Systems Program strategy consists of three elements. These elements are:

(1) identify the available ocean energy resources;

(2) assure technical feasibility and cost effectiveness of potential energy extraction and conversion techniques; and

(3) develop technology to induce industry participation leading to commercial use.

The program is focusing initially on markets subject to high-cost foreign fuels, such as islands (Hawaii, Puerto Rico, Guam, etc.). As costs come down, the program will shift its focus to penetrate the U.S. mainland market during the 1990's. For the conditions prevailing in the case of the highest priority island market, it has been estimated that a 400 MWe OTEC plant could be constructed for about $2000/kW, employing conventional marine concrete construction for both platform and cold water pipe and conventional shell-and-tube heat exchangers made of titanium. If the cold water pipe is constructed of fiber reinforced plastic and if more advanced heat exchangers are assumed, this number decreases to about $1500/kW. The pilot plant, planned to be operational by 1985, is expected to verify operationally that projected capability of the seventh plant to produce power for about 4 cents/kwh.

Program activities contained in the request

The FY 1981 request for the Ocean Systems program is $39 million which represents a $1 million decrease from FY 1980; $0.5 million is requested for project management and will be used for the management by government and contractor organizations of the necessary analyses, data assessment, critique contractor reports, review of contractor designs, and project direction of major hardware programs. Organizations participating in project management are: Argonne National Laboratory (IL), Oak Ridge National Laboratory (TN), Energy and Technology Engineering Center (CA) and Value Engineering (VA). The support for the Solar Division, SERI and San Francisco Operations Office staff management and overview functions are incorporated in this program element.

The $2.9 million requested for definition planning will be used for performing mission definition studies, and resource and environmental assessments. Economic evaluation and comparisons of Ocean Thermal Energy Conversion (OTEC) to existing baseload electric generating systems are continuing.

The FY 1981 budget request for the Technology Development is $8.2 million. This funding will be used for continued developmental activity for subsystems, such as the cold water pipe, electrical cable, power systems, cleaning methods, and the OTEC–1 heat exchanger test platform. Also included will be the initial construction of the Sea Coast Test Facility. Within this element is the development of cost-effective heat exchangers and technically satisfactory cold water pipes and electric cables. Biofouling and corrosion studies are being continued with the primary emphasis being the shift to the first year of testing at the test facility. This element will also include the development of open cycle components.

In FY 1980 the construction of the large 1MWe state of the art shell-and-tube titanium heat exchanger was completed. This unit has design options which can simulate a 10MWe heat exchanger through shrouding. It is to be deployed and operated in June 1980 as the first unit on the OTEC–1 off the Kona Coast of Hawaii. In separate competitive efforts Westinghouse (PA) and Lockheed were selected to provide a smaller aluminum shell-and-tube unit and a titanium plate unit, respectively. The former unit is to be fabricated by September 1980 and the latter unit by June 1981. Funds for the completion of the fabrication of the latter unit are provided in the request.

During FY 1981, Westinghouse will complete a conceptual design study of an open cycle system. An open cycle system flashes the incoming warm water into steam and drives a turbine directly. Therefore, problems associated with biofouling of heat exchangers and ammonia are mitigated. The study provided a unique design which looks much more cost effective than previously estimated. A competition for unique open cycle subsystem approaches is in the process of selection. It is anticipated to proceed with analytical studies in FY 1980 which will then lead to critical subsystem experiments in FY 1981 for flash evaporation, condensation, and large steam turbine expansion.

The Engineering Test and Evaluation budget request for FY 1981 is $20 million. This funding will be used to provide a sea-based component facility for the test of up to five heat exchangers described under technology development and advanced research and technology. Global Marine Development Inc., was selected to convert an existing Navy T-2 tanker. The five heat exchangers will have different enhancements, configurations, materials and cleaning approaches. The objectives of the program will be, first, to verify the thermal performance and then develop long life characteristics. Two goals in demonstrating long life are to qualify lower cost materials such as aluminum and steel, for a marine environment and, secondly, show that cleaning performance will not degrade over time. It is from the OTEC-1 program that several cost-effective heat exchangers are to be qualified in order to establish on industrial base for the continental U.S. market. The Sea Coast Test Facility complements OTEC-1 and provides greater flexibility for testing small scale components.

DOE has planned that the first deployment of OTEC-1 with the early one megawatt heat exchanger will occur in FY 1980. Plans also call for completion of the test operations on the one megawatt system in FY 1981, the vessel brought back to port to be fitted with more advanced heat exchangers, and then redeployed. The funds provided in this category will, therefore, provide for completion of test operations for the first deployment, modification of the vessel for new heat exchangers and initial operations for the second deployment.

Another activity to be continued in this period is the conceptual design of a pilot plant. These efforts will be initiated in the last quarter of FY 1980 and plan to be completed in FY 1981. The pilot plant will be of a sufficient scale to demonstrate integrated system performance and all subsystems to minimize risk for industry to consider commercial systems with government financial incentives. Several user organizations have indicated interest in such a pilot plant by submitting unsolicited cost sharing proposals to DOE.

The Advanced Research and Development program element contains the non-OTEC research activity in the Ocean Systems Program. The request for this element is $3.4 million and will be used for continued investigations of extracting useful energy from waves, ocean currents and salinity gradients.

Committee action

The Committee increased the request for the Ocean Systems program by $6 million to restore funding in FY 1981 to OTEC research activities that suffered delays in FY 1980 due to covering the cost overruns for the OTEC–I Test Facility Project. This increase will reduce the slippage of the OTEC program that will result from the FY 1980 DOE budgetary actions on OTEC–I. Even with this Committee action, the program will have a six months to a year delay in schedule.

In January the Department submitted a Supplemental FY 1980 appropriation request to cover the $6 million overrun on OTEC–I. The supplemental has not been acted on by Congress since it would have broken the FY 1980 budget ceiling. As a result of this the Department has taken steps to fund the overruns from within the OTEC program. They have diverted funding from a series of R&D activities in order to meet OTEC–I project commitments.

6. SOLAR TECHNOLOGY INTERNATIONAL

Solar Technology International

Program description

The international program has the principal objective of accelerating solar energy use in the U.S. by (a) increasing U.S. technical capabilities through international technical cooperation and (b) strengthening U.S. industry through increased exports of solar systems. The program is also guided by foreign policy objectives, which include (1) improved diplomatic relations with specific countries; (2) decreased world dependence on nuclear energy and oil through the accelerated and expanded use of solar energy world wide and; (3) improved balance of trade through the early industrial export of U.S. solar equipment. This program, which is identified as a separate program for the first time in the FY 1981 request, consists of a number of multilateral and bilateral agreement activities. These activities include cooperative research, development and demonstration projects as well as overseas market assessment and development studies. This program is complemented by a similar effort in the Solar Applications area.

The FY 1981 budget request for the solar technology international program is $11 million. The funding will be devoted to cooperative RD&D projects currently being conducted under International Energy Agency agreements and bilateral agreements with Saudi Arabia, Italy and other countries.

The major cooperative projects with IEA involve the construction and operation of two experimental 500KWe solar thermal electric plants in Spain (one central receiver and one distributed). Construction is to be completed and operations are to begin in FY 1981.

The U.S. is cooperating with Saudi Arabia in a joint solar energy program (SOLERAS) in which each country will contribute $50 million over a five year period. A major project in SOLERAS is a solar village power system to be built near two Saudi Arabian villages. This 350KWe photovoltaic village power system is in a final design stage and will be operational during FY 1981.

A joint US/Italian photovoltaic project will begin in FY 1981 as well as a photovoltaic project with Mexico.

DOE has recently submitted to Congress, the International Photovoltaic Program Plan, that was called for by section 11 of Public Law 95-590, the Solar Photovoltaic Energy Research, Development and Demonstration Act of 1978. The program outlined in the plan includes demonstration, system development, supplier and purchaser assistance and information dissemination. These program activities are intended to stimulate growth of the U.S. photovoltaic industry by promoting expanded worldwide sales of U.S. manufactured photovoltaic systems that serve the energy needs of developed and developing countries.

The program will be initiated in FY 1981 with funding from the multi year photovoltaic purchase strategy.

COMMITTEE ACTION

The Committee increased the requested authorization for the Solar International program under Solar Technology by $12 million, to initiate the program outlined in the January 1980 DOE International Photovoltaic Program Plan.

For the first time, DOE has broken out its international solar activities as separate programs in the FY 1981 request (Solar Applications International—$4 million and Solar Technology International—$11 million). Of the $11 million requested for Solar Technology International, $6.9 million is for photovoltaic activities under bilateral agreements.

In January 1980 DOE submitted the International Photovoltaic Program Plan to Congress. The preparation of this plan was mandated by Section 11 of Public Law 95-590, the "Solar Photovoltaic Energy Research Development and Demonstration Act of 1978." The legislated requirement to prepare this plan was included in Public Law 95-590 in recognition of the vital role the foreign market will play in the growth and maturing of the Photovoltaic industry over the 10 year life of the photovoltaic program. The foreign market for photovoltaic arrays and systems has long been identified as the transition market for the photovoltaic industry from the small, remote, high-cost application to the large, low-cost, grid-connected domestic application market. The foreign market has been estimated to be between 10's of megawatts in annual sales to as much as 500 megawatts by the end of the 10 year program. The activities that are outlined in the International Photovoltaic Program Plan could assure the U.S. photovoltaic industry a majority share in the expanding world photovoltaic sales.

The Committee added this funding to the international program since the international photovoltaic program should be managed and funded out of the Office of the Deputy Assistant Secretary for Field Operations and Solar International Programs and not out of the Photovoltaic Program, which is more interested in research and development than international market development.

H. Geothermal and Hydroelectric Energy

1. GEOTHERMAL ENERGY

[In thousands of dollars]

				Committee action	
	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Changes to original authorization request	Total authorization
Operating expenses:					
Hydrothermal energy	45, 150	51, 113		−10, 500	40, 613
Geopressured resoures	35, 700	35, 800		0	35, 800
Geothermal technology development	38, 900	51, 890		−10, 000	41, 890
Geothermal resources development fund	0	1, 091		0	1, 091
Subtotal, operating	119, 750	139, 894		−20, 500	119, 394
Program direction	1, 962	2, 569		0	2, 569
Subtotal	121, 712	141, 179		−20, 500	120, 679
Capital equipment:					
Hydrothermal resources	800	0		0	0
Geopressured resoures	300	200		0	200
Geothermal technology development	2, 100	1, 110		0	1, 110
Subtotal, capital equipment	3, 200	1, 310		0	1, 310
Construction:					
Authorization		10, 911		8, 000	18, 911
Budget authority	24, 450	10, 911		8, 000	18, 911
Total, authorization		154, 684		−12, 500	141, 911
Total budget authority	149, 362	154, 684		−12, 500	141, 911

[1] Indicates changes to original FY 1981 B/A request.

The function of the geothermal energy program is to accelerate commercial use of the abundant geothermal resources of the United States for electric power generation, direct heat uses, and production of methane (from geopressured resources). The DOE's role is to conduct reservoir assessment, research, development, and demonstration programs, and to assess and (in cooperation with other organizations) mitigate economic, legal, environmental and regulatory roadblocks to geothermal development.

Three types of geothermal resources have the potential to contribute to the Nation's energy economy by the year 2000. These are hydrothermal, geopressured, and hot dry rock resources. Hydrothermal resources consist of water and steam trapped in fractured rocks or porous sediments at moderate to high temperature. Geopressured resources consist of moderately hot water and methane under abnormally high pressures. Hot dry rock resources consist of moderate to high temperature rocks at accessible depths that are relatively unfractured and contain little water.

Of the three types, hydrothermal resources are most ready for commercialization, because more is known about them and because they can be used economically now. Cost reductions through improved technology and financial incentives will greatly increase the number of hydrothermal reservoirs that will be economically accessible in the future. Commercial development of geopressured energy may begin in the mid-1980's if uncertainties about resource characteristics are reduced, and if the economic aspects of methane recovery prove to be favorable. Hot dry rock energy extraction is currently seen as a longer-term possibility; commercialization could begin as early as the mid 1990's if significant improvements in drilling and fracturing technology are achieved.

Various federal agencies are involved in the geothermal program. DOE, designated as the lead agency for the federal geothermal program, works through the Interagency Geothermal Coordinating Council (IGCC) to foster coordination among agencies involved in the federal program. The Council, chaired by DOE, is made up of high-level representatives from each of the agencies actively involved in geothermal resource development. Council members include, among others, the Departments of Treasury, Interior, Housing and Urban Development, Commerce, Defense, and Agriculture, and the Environmental Protection Agency. Most of the federal R&D effort is carried out by DOE and the Department of the Interior. Within DOE, the Geothermal subprogram is conducted within the Office of the Assistant Secretary for Resource Applications.

The DOE Geothermal subprogram has both technology and nontechnology objectives. Technology objectives are to (1) reduce costs and uncertainties of reservoir exploration, development, and utilization, (2) develop and demonstrate efficient and economical energy conversion technologies for use in a wide range of temperatures and fluid salinities, (3) develop durable cost-effective materials for use in geothermal environments, and (4) develop and demonstrate effective environmental control technology. Nontechnology objectives of the geothermal program are to (1) reduce institutional barriers such as tax and legal uncertainties, (2) streamline leasing, regulatory, and permitting procedures, (3) provide incentives to enhance geothermal's competitiveness with other energy technologies, and (4) assure effective transfer of the technology to private industry.

The basic authorizing statutes for the federal geothermal program are the Geothermal Energy Research, Development, and Demonstration Act of 1974 (P.L. 93–410), which established the Interagency Geothermal Coordinating Council (IGCC; the Energy Reorganization Act of 1974 (P.L. 93–438), the Federal Nonnuclear Energy Research and Development Act of 1974 (P.L. 93–577); and the Department of Energy Organization Act of 1977 (P.L. 95–91) as amended. The latter, which updated and consolidated earlier Acts, gave DOE the lead role in the federal geothermal program and reemphasized the Government's commitment to commercial development of geothermal resources.

The legal framework for geothermal development on federal lands is provided by the Geothermal Steam Act of 1970 (P.L. 91–581), which authorizes the Secretary of the Interior to issue geothermal leases on certain public lands and to issue regulations regarding geothermal development on those lands.

The Energy Tax Act of 1978 (P.L. 95–618), part of the National

Energy Act (NEA), provides several economic incentives for geothermal development. These include intangible drilling cost deductions, a percentage depletion allowance applied to income from geothermal reservoirs, and residential and business investment tax credits for geothermal projects. Tax savings resulting from the NEA provisions can help reduce the amount of "at risk" investment in a geothermal project.

In addition to the aforementioned basic legislation, provisions of two other laws will further geothermal development. These are The Public Utility Regulatory Policies Act of 1978 (P.L. 95-617), which empowers the Federal Energy Regulatory Commission to order interconnection and wheeling arrangements for small electric power production facilities, including geothermal facilities, and The Power Plant and Industrial Fuel Use Act (P.L. 95-620), which encourages the use of coal and alternate fuels, including geothermal energy, in electric power generating plants and major fuel burning installations.

The FY budget request by DOE for the geothermal energy program represents an increase of $3.662 million over the FY 1980 estimate. Of the four program elements, the largest increase is requested for activities under the Geothermal Technology Development program element. Within this program element, the Component Development subelement shows the greatest increase ($12.6 million) over FY 1980. This additional funding will support the development of technology to achieve the necessary cost reductions. The Hydrothermal Resources program element shows an overall decrease due principally to reduced funding requirements in FY 1981 for construction of geothermal electric power pilot and demonstration projects in Idaho, Hawaii, and New Mexico. Increases are requested for Resource Definition, Non-Electric Applications, and Environmental Control activities. Geopressured funding remains at the FY 1980 level to support a continuing program of well drilling and testing on the Texas and Louisiana Gulf Coast. A minor reduction is requested for the Hot Dry Rock subelement, in which an energy extraction experiment is being conducted at Fenton Hill. New Mexico.

SUMMARY OF COMMITTEE ACTIONS

The Committee cut $12.5 million from the $154.684 million requested for geothermal energy, and redirected $10 million of the remaining funds to the second 50 MWe demonstration facility. Specifically, the Committee cut $10.5 million from Hydrothermal Energy and $10.0 million from Geothermal Technology Development, and added $8.0 million to Construction Projects. See Section M, Construction of Facilities, for further details.

The Committee also moved the Hydrothermal Commercialization activity back into Title I of the Bill, where it was in the previous authorization. It had been placed in Title II. This change is consistent with DOE's recent consolidation of this activity under RD&D management.

(a) Hydrothermal Energy

[In thousand of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request	Committee Action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Hydrothermal commercialization:					
Planning and analysis	4, 570	4, 551		−500	4, 051
Private sector development	4, 430	4, 473		−1, 500	2, 973
Hydrothermal resources:					
Resource definition	13, 406	19, 398		−1, 000	18, 398
Non-electric applications	12, 200	16, 000		−5, 500	10, 500
Environmental control	1, 300	2, 600		0	2, 600
Facilities:					
Valles Caldera, SOMW	50	1, 139		0	1, 139
Raft River pilot plant	4, 452	2, 452		0	2, 452
Geothermal loop experimental facility	500	0		0	0
HGP–A wellhead generator	3, 642	0		0	0
Geothermal component test facility	600	500		0	500
General cut				−2, 000	
Subtotal, operating	45, 150	51, 113		−10, 500	40, 613
Capital equipment	800	0		0	0
Total, hydrothermal energy	45, 950	51, 113		−10, 500	40, 613

HYDROTHERMAL COMMERCIALIZATION

Objectives

The major objective of this program element is to accelerate commercial use of hydrothermal resources for electric power and for direct heat applications so that geothermal energy can make a significant contribution to domestic energy production. The two subelements are Planning and Analysis and Private Sector Development.

Description

Planning and Analysis

Planning and Analysis activities are aimed at establishing hydrothermal program needs, priorities, and strategies. Analyses of the economics of geothermal energy use, market penetration, institutional and legal barriers, and federal policies support the planning function.

Under this subelement, DOE prepares commercial development plans on site-specific, regional, and national levels, and monitors progress toward hydrothermal commercialization objectives. DOE also supports the Interagency Geothermal Coordinating Council (IGCC), which provides a forum for the review and analysis of federal policies, regulations, and legislation that may affect geothermal commercialization. Analysis of barriers to commercialization is coupled with energy market studies to establish the market penetration potential of hydrothermal resources and to support the design of effective marketing strategies.

Private Sector Development

This subelement seeks to stimulate private sector development of hydrothermal resources through identification of site-specific commercial opportunities for direct heat applications and direct developer/use participation and cost-sharing in feasibility analyses and demonstration projects. The subelement also includes an outreach effort comprised of technical consultation with potential end users and information dissemination.

DOE is also working to stimulate private sector interest in geothermal direct heat applications by cooperating with industry in studies to determine technical and economic feasibility and market potential of geothermal direct use for pulp and paper manufacturing, district heating, food and mineral processing, and agricultural drying.

Significant Accomplishments to Date

In FY 1979 and FY 1980, geothermal energy market assessment studies were completed for 15 western states and 4 geothermal areas in the northeast. The assessment of four areas in the southeast will be accomplished by the end of this year. Market penetration analyses for each of the 10 Rocky Mountain Basin and Range states have identified a potential market penetration of .1 to .5 quads for direct heat application in these states. The operation of the National Progress Monitor for geothermal development began late in 1979.

Four centers established in Oregon, Idaho, Utah, and Maryland furnish technical consultation to prospective hydrothermal resource users and provide both information on hydrothermal resources and their applications and community assistance in development planning. As part of the geothermal outreach program, workshops were held in ten states to assist the legislatures to define legislative needs to foster geothermal development in their states.

Activity Highlights/Milestones

Planning and Analysis.—Site specific commercial development planning in 15 western states will be completed. Planning support for selected areas of the Atlantic Coastal Plain will continue for a second year. State legislative reviews in six additional states (for a total of 18) will identify legal barriers to geothermal development and to assist the states in developing mitigation measures. The National Progress Monitor will continue to measure the pace of commercial geothermal development. Support for the activities of the Interagency Geothermal Coordinating Council and the Geothermal Panel of the Energy Research Advisory Board will be continued.

Private Sector Development.—Market penetration analyses will continue to define the locations and sizes of markets for geothermal energy. Seven to nine new site-specific engineering and economic studies will emphasize industrial uses of geothermal direct heat. In addition, the technical assistance centers will continue to aid prospective resource developers. Information dissemination activities related to opportunities for direct utilization of geothermal energy will be strengthened.

COMMITTEE ACTION

Hydrothermal Commercialization—$2.0 million decrease

The Committee added the $10 million Hydrothermal Commercialization activity back into the Hydrothermal energy subprogram and reduced it by $2 million. This activity was initiated as a result of the Geothermal Research, Development and Demonstration Act of 1974 and has, in the past, been funded as part of the RD&D budget. The Committee recognized that it was separated from the RD&D program primarily because the Department had separated the program direction for these activities between two assistant secretaries. The Department then recombined these activities under the direction of the Assistant Secretary for Resource Applications, but did so after the budget proposal had been prepared. Consequently, the funding was not recombined as it should have been. The $2 million reduction consists of a $0.5 million cut in barrier analysis for specific industries, and a $1.5 million cut in new proposed pilot projects.

HYDROTHERMAL RESOURCES

Objectives

The major objective of the Hydrothermal Resources program element is to support the growing commercial development of this resource for electric power generation and direct heat applications. Subelements of this program element are Resource Definition, Non-Electric Applications, Environmental Control, and Facilities.

The Resource Definition subelement confirms hydrothermal reservoirs to assure sufficient fluid reserves to meet near-term utilization goals and identifies new prospects for long-term growth.

Non-Electric Applications projects demonstrate technical and economic feasibility of the direct use of hydrothermal energy by supporting cost-shared field experiments and related studies.

The Environmental Control subelement (1) develops and demonstrates technologies required to meet environmental, health, and safety standards for geothermal utilization at reasonable cost and (2) satisfies requirements of the National Environmental Policy Act for environmental impact analyses.

The Facilities subelement stimulates non-federal development of liquid-dominated hydrothermal resources for electric power generation through both pilot scale and commercial scale demonstrations of geothermal systems.

Description

Resource Definition

This subelement focuses on assessment of U.S. hydrothermal reservoirs and confirmation of hydrothermal prospects through selected drilling and testing projects. National and regional resource assessments are conducted in cooperation with the U.S. Geological Survey. DOE also cooperates with state agencies to identify and confirm low-to-moderate temperature reservoirs for direct heat applications, and with industry to confirm high temperature reservoirs with near-term commercial potential for electric power production.

Non-Electric Applications

The Non-Electric Applications subelement supports 22 cost-shared demonstration projects in varied geographical regions. The projects are directed toward several market sectors: industrial processing, agribusiness, and space/water heating for commercial and residential buildings. These projects will demonstrate the feasibility of using geothermal fluids for a variety of direct heat applications while providing the needed engineering and economic data and "hands-on" experience to foster wider use of this alternative energy source.

Environmental Control

Environmental control activities include: (1) development of environmental, health, and safety standards, (2) development and demonstration of control technology to ameliorate adverse affects of geothermal energy production, (3) consideration of environmental issues in the decision-making stages of geothermal planning and implementation, (4) collection of field data to support preparation of Environmental Assessments and Environmental Impact Statements (EA/EIS), and (5) monitoring of major field projects to assure compliance with environmental requirements.

Facilities

Geothermal electric power generation facilities demonstrate the technical reliability and environmental acceptability of integrated geothermal systems at predictable operating costs. Facilities supported by this subelement include: (1) a 50 MWe commercial scale demonstration power plant at Valles Caldera, New Mexico, (2) a 5 MWe binary cycle pilot plant in the Raft River area of Idaho, (3) the Geothermal Loop Experimental Facility at Niland, California, (4) a 3 MWe well-head generator at a geothermal well in Puna, Hawaii, and (5) the Geothermal Component Test Facility in East Mesa, California.

Significant Accomplishments to Date

Resource Definition.—With DOE support, the U.S. Geological Survey has completed a major update of its assessment of U.S. geothermal resources; results were published in January 1979 as USGS Circular 790. The update reaffirms the existence of large amounts of energy contained within the hydrothermal and geopresured resource bases.

As part of the effort to identify and test hydrothermal resources for possible development, a DOE well was drilled at Crisfield, Maryland, in FY 1979. Production tests of this well confirmed the existence of hydrothermal resources on the Atlantic Coastal Plain. A second exploratory well will be drilled on the Delmarva Peninsula in FY 1980, in cooperation with a potential direct heat user.

Four state maps showing the locations of probable low and moderate temperature reservoirs for direct heat applications were published in FY 1979. Several additional maps are scheduled for FY 1980.

In FY 1979, DOE shared with industry the cost of drilling nine wells in Utah and Nevada to confirm high temperature reservoirs suitable for electrical power production. Twelve more wells are planned;

most of these will be completed in FY 1980. In addition, two deep exploration wells will be drilled in FY 1980 near Mt. Hood, Oregon, as part of the joint DOE–USGS regional resource assessment of the Cascade Mountains in the northwestern United States.

Non-Electric Applications.—During FY 1979, DOE initiated 15 additional direct heat demonstration projects, bringing the total to 22. To date, seven reservoirs have been confirmed for these projects; eight had been confirmed prior to DOE involvement. One well drilled near the Ore-Ida plant in Oregon reached high-temperature at 10,000 feet but was dry. The well is now being considered for well stimulation treatment or hot dry rock research.

Environmental Control.—A hydrogen sulfide removal system has been successfully tested at The Geysers geothermal field in California. Better than 98 percent removal efficiency was achieved. The system was developed by the EIC Corporation under a cost-sharing contract between DOE and the Pacific Gas and Electric Company (PG&E). The Environmental Protection Agency participated in the test program.

Facilities.—The final cooperative agreement between DOE, Union Oil, and the Public Service Company of New Mexico to cost-share the design, construction and operation of a commercial-scale (50 MWe) flash-steam electric power demonstration plant was completed in August 1979. Construction is scheduled to begin in May 1980 and plant operation is scheduled for 1982. The environmental impact statement was published in January 1980.

Construction of the Raft River Pilot Plant is about 80 percent complete. The system is now being fitted with a turbine generator set and additional well tests are being undertaken. Operation of the plant at Malta, Idaho is scheduled for FY 1981.

Construction of the Hawaii Wellhead Generator is on schedule and major equipment has been ordered. This project is expected to lead to commercial applications of well-head generators in remote areas of the western U.S. and Hawaii. Operation is scheduled to begin in FY 1981.

Testing at the Geothermal Loop Experimental Facility (GLEF) has been completed. The project, which was, cost-shared with the San Diego Gas and Electric Company, addressed a variety of environmental and operational problems such as scaling, corrosion, and injection fluid handling. Experiments began in FY 1978 and the facility is being decommisisoned in FY 1980. The data derived from its operation have prompted a private developer to initiate negotiations for a commercial size flash-steam plant at the same site.

Activity Highlights/Milestones

Four more states (for a total of 31) will be included in the state-coupled program to identify geothermal reservoirs of low and moderate temperatures suitable for direct heat applications.

Because the risks inherent in exploratory drilling have been identified as the most significant barrier to the development of low and moderate temperature resources, a user-coupled reservior confirmation program, similar to the industry-coupled reservoir confirmation program for high temperature resources, will be initiated in FY 1981.

Also in FY 1981, DOE will phase out the industry-coupled high-temperature reservoir confirmation program in Utah and Nevada as previous commitments are fulfilled and the National Energy Tax incentives take effect.

DOE will continue in FY 1981 the reservoir confirmation drilling and construction activities for the 22 direct heat hydrothermal demonstration projects initiated in FY 1978 and FY 1979 and will initiate two new projects to demonstrate the use of geothermal energy for energy-intensive industrial processes.

The environmental control technology program will be expanded to include seismic monitoring in areas presently under development. DOE also will continue to develop a system to monitor compaction and subsidence at depth, and will initiate new research programs to develop cost-effective methods of controlling liquid and gaseous affluents.

During FY 1981, DOE plans complete construction and initiate operation of the Hawaii 3 MWe Wellhead Generator. The 5 MWe Raft River Binary Pilot Plant will be operated at maximum capacity to collect technical and cost information for these pilot-scale systems. Final design for the 50 MWe Flash-Steam Demonstration Plant will be completed and construction will be well under way during FY 1981.

COMMITTEE ACTION

Hydrothermal Resources—$8.5 million decrease

The Subcommittee reduced the funding for Hydrothermal Resources by $8.5 million. This reduction consists of a $1 million cut from the State-coupled assessment activity, which reduces the level of effort; a $5.5 million cut in new projects related to industrial uses of geothermal energy; and a $2 million cut which may be spread in any appropriate proportion over all the activities of this subprogram including the operating expenses for the five facilities.

The Committee reduced the funding for the first 50 MWe Geeothermal Demonstration Power Plant Project at Valles Caldera, New Mexico by $2.0 million to eliminate unnecessary budget authority. The Committee expects that this cut will have no immediately forseeable impact on the FY 1982 completion date of this facility.

The Committee added $10 million for construction of the second 50 MWe Demonstration Power Plant Project. The Administration requested no funding for this facility for the third year, although the Committee recognized that the Department was proceeding with the project and that it was omitted from the budget only because the funding mechanism for this cost-shared project had not been determined at the time of budget preparation. The Committee feels strongly that this project must proceed to demonstrate the commercial peditiously with the design and construction of this plant. See Section M, Construction of Facilities, for further details.

(b) GEOPRESSURED RESOURCES

Objectives

The objective of the Geopressured program element is to establish the technical and economic feasibility of producing energy from geopressured resources and thus to encourage commercial development by the private sector. Specific objectives are to determine (1) the magnitude of the resource base, (2) the amount of methane technically feasible to produce, (3) the probable production lifetimes of individual reservoirs, (4) the economics of methane production, (5) the economics of developing the associated thermal and hydraulic energy, assuming that methane recovery is economical, and to resolve the environmental and institutional issues associated with developing the geopressured resource.

Description

Geopressured aquifiers, 10,000 to 20,000 feet deep, occur along the Texas and Louisiana Gulf Coast. Resource assessment efforts have identified numerous candidate sites for exploration. Extensive data from thousands of deep wells, drilled originally for oil and gas, prove the existence of these high-temperature, high-pressure zones and identify the geologic conditions under which they occur. The resource is estimated to contain about 170,000 quads of energy in the forms of methane and heat and thus constitutes a major U.S. energy target. The existing Gulf Coast oil and gas production industry is expected to undertake rapid commercial development of geopressured resources, if it is shown that the resource base is large and that its energy content can be tapped economically without adverse environmental effects.

The Geopressured program element focuses on production tests of both new drilled wells and existing wells originally drilled in the course of exploration for conventional oil and gas deposits. Environmental monitoring is conducted at the well sites during the production tests. In addition, the program supports engineering activities aimed toward developing systems for optimum energy recovery. Subelements of this program element are Program Coordination, Resource Definition, Engineering Applications, and Environmental Control.

Program Coordination

The purpose of this subelement is to determine the economic, environmental, institutional, and technological viability of developing the geopressured resource and to provide overall program planning. Policy options and technical programs are assessed in coordination with federal, state, and local government agencies, industries, utilities, field operators, and public interest groups. This coordination of regional planning activities is organized through Louisiana State University and the University of Texas at Austin.

Resource Definition

The purpose of this subelement is to determine location, size, temperature, pressure, methane content, and production characteristics of geopressured aquifers along the Texas and Louisiana Gulf Coast. This analysis is based on geophysical logs from thousands of existing wells, on seismic surveys and core analyses, and on production testing of both new and existing wells. Existing well tests are used to obtain geopressured aquifer data, including methane content, at moderate production rates in tests lasting only a few weeks. These conventional oil and gas wells, however, are not suitable for the long-term tests needed to define reservoir productivity and longevity, nor for assessment of the environmental effects of large-scale production and the economic and technical aspects of brine production and disposal. DOE is designing and drilling wells for the long-term tests at high flow rates considered necessary for commercial operation.

Engineering Applications

Efforts in this area are directed toward reducing the cost of developing and using geopressured resources. The program is carried out under two categories: (1) surface technology and resource utilization, and (2) well drilling and completion.

Surface technology and resource utilization activities address methane fuel production, direct heat utilization, and electricity production. This work includes the conceptual design of facilities and preliminary economic analyses related to production, conversion, and utilization costs.

Well drilling and completion technology work focuses on problems related to the high temperature, pressure, and salinity associated with geothermal wells.

Environmental Control

This subelement includes support for continued research on possible environmental effects of sustained high volume production of geopressured brines. Land subsidence is the principal concern addressed by environmental research. The environmental implications of disposing of geopressured well fluids are also being observed through test well monitoring.

Significant Accomplishments to Date

Program Coordination.—Studies focusing on the legal issues surrounding geopressured resource development have been carried out by Louisiana State University and the University of Texas.

Resource Definition.—For the geopressured resource assessment program along the Texas and Louisiana Gulf Coast, DOE mapped in FY 1979 the Wilcox and Vicksburg formations in Texas. The mapping activity, together with the previous studies of the Frio formations in Texas and the Miocene sands in southern Louisiana, will enable the selection of prime reservoirs for the drilling and testing program. In FY 1979, five additional reservoirs were identified in south Louisiana for a total of 10 now available for testing. In Texas, several promising areas in the Wilcox formation were identified and will be considered for testing with the five previously identified reservoirs in the Frio formation.

In FY 1979, the geopressured testing activities included drilling and initial testing of the first well designed for long-term production in Brazoria County, Texas. In addition, two tests of existing wells were conducted in Louisiana. All of these tests indicated that the geopressured fluids were saturated with methane, although higher than expected fluid salinities were encountered, thereby reducing gas to water ratio. In FY 1980, DOE plans to drill two additional new wells in south Louisiana and negotiate a contract for a third well, also in Louisiana.

Environmental Control.—The Pleasant Bayou Test Well has been instrumented to measure a range of environmental parameters, including subsidence, micro-seismicity, and air and water quality. Data obtained from the monitoring of the well tests will be used to assess the potential impact of geopressured aquifer development.

Activity Highlights/Milestones

Resource Definition.—In FY 1981, DOE will continue efforts to reduce the uncertainties of resource recoverability by drilling three new wells designed for high-rate long-term production testing in the optimum areas identified in the geopressured resources assessment program. Testing of these wells will be started, and the long-term testing of four wells drilled in FY 1979 and FY 1980 will continue. In addition, DOE will complete and test three existing wells drilled for conventional gas exploration which penetrated geopressured aquifers.

Engineering Applications.—Preliminary results of market analyses and well production tests will become available in FY 1981. DGE will use these results as a basis for a decision on whether to proceed with experimental facilities for electric power generation and direct heat applications from geopressured resources.

A program to develop and demonstrate equipment and production methods for recovering energy from geopressured resources also will be carried out in FY 1981.

Environmental Control.—Environmental assessment and monitoring of well sites in Texas and Louisiana will be accelerated to keep pace with the drilling and flow tests. Appropriate environmental impact assessments will be prepared as necessary in connection with DOE well testing activities.

COMMITTEE ACTION

Geopressured Resources—No Change

The Committee recommended no change in the Geopressured subprogram. This reflects the fact that more research, development and demonstration is needed in this subprogram than for the other subprograms in order to bring this promising resource to the point where it can be economically developed by the private sector.

(c) GEOTHERMAL TECHNOLOGY DEVELOPMENT

[In thousand of dollars]

				Committee Action	
	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised Fiscal year 1981 DOE authorization request	Changes to original authorization request	Total authorization
Operating expenses:					
Hot dry rock	14, 000	13, 500		0	13, 500
Component development:					
Drilling and completion technology	7, 000	8, 250		0	8, 250
Stimulation	3, 000	4, 500		−1, 500	3, 000
Energy conversion	7, 100	12, 800		−3, 500	9, 300
Geochemical engineering and materials	3, 600	5, 005		−500	4, 505
Geosciences	4, 200	7, 835		−1, 500	6, 335
General cut in budget				−3, 000	
Subtotal, operating	38, 900	51, 890		−10, 000	41, 890
Capital equipment	2, 100	1, 110		0	1, 110
Total, geothermal technology development	41, 000	53, 000		−10, 000	43, 000

COMPONENT TECHNOLOGY DEVELOPMENT

Objectives

The objective of this subprogram is to reduce geothermal costs by improving technology, thus expanding the economically recoverable resource base.

Description

Drilling and Completion

This subelement supports the development of advanced drill bits, downhole motors, drilling fluids, well completion methods, and advanced drilling systems that could reduce the cost of geothermal wells by as much as 25 percent by 1983 and 50 percent by 1986.

Energy Conversion Technology

The objective of this subelement is to reduce geothermal electric power generating costs. The program emphasizes technology for converting the heat content of moderate temperature resources to electric power; moderate temperature hydrothermal reservoirs constitute a much larger resource base than high-temperature resources, but are inherently more expensive to exploit. The subelement is directed toward system performance improvements and cost reductions in binary system components, particularly heat exchangers which now account for 50 to 70 percent of binary plant costs.

Reservoir Stimulation

Stimulation technology is used to increase the fluid productivity of geothermal wells. Reservoir stimulation methods for oil and gas wells have been used commercially for years, but the high temperatures and geologic conditions of geothermal reservoirs demand different stimulation methods. Stimulation techniques such as chemical treatment and hydraulic or explosive fracturing can increase well productivity, thereby decreasing the number of wells required for a project.

Geochemical Engineering and Materials

This subelement concentrates on increasing geothermal plant efficiency through improved fluid management techniques and on developing economical materials durable enough to be used in a wide variety of geothermal environments.

Fluid disposal procedures and injection well maintenance procedures are being developed to control waste and optimize the potential for beneficial use of geothermal waste byproducts.

Materials activities include development of drill pipe inspection techniques, economical materials for piping and pressure vessels elastometers, and corrosion-resistant metals and non-metallics for bearings, cables, seals, drill bits, pumps, and well casings. High-temperature chemical probes are being developed to minimize scaling and improve control of geothermal fluid systems.

Geosciences

The Geosciences subelement includes exploration technology, reservoir engineering, logging instrumentation, and log interpretation. Exploration technology is designed to improve the accuracy of predrilling reservoir assessments. Reservoir engineering is concerned with accurate prediction of reservoir productivity and longevity. Other geosciences activities include the development of measuring devices that can survive geothermal environments and of geothermal well log interpretation techniques to determine reservoir characteristics from borehole information.

Significant Accomplishments to Date

Drilling and Completion.—Successful tests of improved drilling technology have given confidence that the 25 percent drilling cost reduction goal will be achieved by 1983. An improved unsealed roller cone bit designed for drilling hot, hard, fractured rock was developed, successfully field tested at The Geysers Geothermal Field in California, and commercialized. A successful field test of a downhole replaceable chain drill bit has confirmed the cost benefit of changing the cutting surface of the bit downhole.

A recently demonstrated technique for removing scale from pipe provides a nondestructive and efficient method for cleaning heat exchangers. The same basic technique can be applied to scale removal from production and injection wells.

Plans for development of an advanced drilling system have been formulated. Concepts under review include high speed motors and bits, percussion drilling systems, and jet drilling.

Energy Conversion Technology.—The one-megawatt helical screw expander, a transportable wellhead generator system, was refurbished after a successful field test in Utah and made available under a cooperative agreement to the International Energy Agency (IEA) for testing at geothermal fields in Mexico, Italy, and New Zealand.

A 500-KWe skid-mounted binary power system employing direct contact heat exchangers has been installed at East Mesa and has undergone preliminary testing.

A 100-KWe transportable power system utilizing direct contact heat exchangers has been constructed and installed at a test site near El Dorado, Arkansas.

The preliminary design of components for a 5 MWe gravity head binary cycle system was completed and major components and subsystems have been ordered for assembly and installation in a test well in the Imperial Valley of California.

Several months of unattended continuous operation of the 60-KWe binary plant at Raft River have provided new data on the reliability of binary system operation with moderate-temperature geothermal fluids.

Joint DOE/Electric Power Research Institute heat exchanger equipment tests have begun at the East Mesa geothermal component test facility.

Reservoir Stimulation.—An active well stimulation program has begun with experiments on two wells at Raft River, Idaho. Stimulation resulted in a significant increase in production from one well and no discernible change in production from the second. New tools and techniques for performing explosive stimulation of a well at The Geysers have been developed.

Geochemical Engineering and Materials.—An analysis of available materials for use in geothermal applications has been completed; this work will aid in the design of geothermal electric power plants. New probes have successfully monitored corrosion and scale formation in an operating geothermal pilot plant.

Recently developed polymer concrete, high-temperature elastomers, and casing materials have shown significant improvements in durability and corrosion resistance.

Activity Highlights/Milestones

Drilling and Completion.—In FY 1981, research and development activities will be directed to conventional rotary drilling equipment and materials such as drill bits, downhole motors, drilling fluids and completion equipment to reduce the costs of drilling in hostile geothermal environments. In addition, systems engineering and development of advanced drilling concepts for greater cost reductions will be initiated.

Stimulation.—In FY 1981, DOE will conduct up to six field stimulation experiments in higher-temperature reservoirs and will support development of high-temperature hydraulic fracturing equipment and materials to back up the stimulation experiments. Chemical interactions between hot geothermal formations and acids used to dissolve calcium carbonate and silica also will be examined.

Energy Conversion.—During FY 1981, DOE will continue tests of a 500 kWe skid-mounted (isobutane) binary cycle power system employing direct-contact heat exchangers at East Mesa, California, and a 100 kWe low-temperature (pentane) direct-contact power system at El Dorado, Arkansas. In addition, work will proceed from the design phase to the construction phase for a high-efficiency gravity-head binary power system, employing a downhole heat exchanger to increase efficiency of transfer and a thermal siphon effect to eliminate mechanical feed pumps. The gravity head system will be constructed at East Mesa, California.

Geochemical Engineering and Materials.—In FY 1981, DOE research and development activities will address site-specific problems plaguing developers such as production well plugging due to calcium carbonate scale buildups, surface line plugging due to silica and heavy-metal sulfides, fouling of heat exchangers, and plugging of reinjection wells.

Geothermal materials research will emphasize non-metallic materials. High-temperature cements for well completions and reinforced polymer concrete pipe and concrete-lined pressure vessel for scale-control in surface equipment will be field tested. Scheduled for fabricating and testing are high-temperature elastomeric seals for down-hole pumps, motors, and stimulation equipment and metallic seals for very high-temperature applications.

Geosciences.—Field tests of several geophyscial exploration techniques will be conducted in areas where geothermal development has occurred to permit validation of the techniques with actual production history. In reservoir engineering, development and validation of computer models for predicting reservoir performance will be accomplished. DOE will also develop high-temperature logging tools and cables in order to obtain much needed reservoir data for geothermal field expansion and, in addition, will continue to develop logging interpretation techniques suited to geothermal geologic formations.

HOT DRY ROCK

Objectives

General objectives are (1) to determine the potential of the HDR resource, (2) to verify that the requisite technology for developing the resource exists, and (3) to bring about commercial exploitation of HDR before the end of the century. A major program review is scheduled for FY 1986, when an examination of technical and economic feasibility will determine whether the subprogram should be continued.

Description

A concept for extracting energy from hot dry rock has been demonstrated at Fenton Hill, New Mexico, where a five-megawatt thermal loop was operated in 1978. In addition to conducting long-term operational tests of HDR energy extraction techniques, the program's scope is being broadened to include planning, economic, and resource definition studies on a national scale.

Significant Accomplishments to Date

In FY 1979, DOE initiated the drilling of the first well for a 20–50 MW (thermal) loop at Fenton Hill, and executed an agreement with the Federal Republic of Germany (FRG) for their participation in the Fenton Hill project. The FRG will provide up to $2,500,000 per year for 4 years.

Activity Highlights/Milestones

In FY 1981, DOE will complete the drilling of the second well required for the 20–50 megawatt thermal loop at Fenton Hill, and will initiate hydraulic fracturing operations to construct the downhole heat exchange area and begin construction of the surface facilities. Support for the equipment development program, required for high-temperature operations at Fenton Hill and future sites, also will be provided.

In FY 1981, under the hot dry rock resource assessment program, a second site with different geologic characteristics than Fenton Hill will be selected for future extraction experiments.

INTERNATIONAL GEOTHERMAL ENERGY ACTIVITIES

Objectives

Objectives of U.S. participation in international geothermal programs are to expand the geothermal data base through information exchange between cooperating nations and to help ensure that experience gained in other countries is available to U.S. developers.

Description

Geothermal resource potential has been identified in over 20 countries. Existing worldwide installed capacity is 1978 MWe, with planned additional capacity of 3641 MWe.

The United States participates in international geothermal energy programs through multilateral and bilateral agreements with other nations. These agreements, which can enhance domestic commercialization, cover both exchanges of information and cooperative research and development efforts.

Significant Accomplishments to Date

The United States and the Federal Republic of Germany (FRG) have signed an agreement providing for participation of German scientists in the Los Alamos Scientific Laboratory (LASL) Hot Dry Rock program. The FRG will fund 25 percent of the Fenton Hill project, up to a maximum of $2.5 million a year; the agreement will be effective for an initial period of four years. In addition, a cooperative agreement under the International Energy Agency (IEA) has been signed for testing of a U.S. manufactured wellhead generator unit (helical screw expander) in Mexico, New Zealand, and Italy.

The United States has also made major bilateral agreements with Italy, Japan, Mexico and New Zealand.

The United States and Italy have exchanged reservoir data and information on drilling techniques and materials. Reservoir assessment activities have included testing of a computer model at Lardarello, Italy. The United States has also provided environmental monitoring equipment and cooperated in seismic studies.

The first meeting of an executive coordinating committee for United States-Japan cooperation addressed possible projects relevant to binary conversion systems and the LASL hot dry rock program.

Cooperative investigations between the United States and Mexico on the geophysical and hydrological characteristics of the Cerro Prieto field continued in FY 1979. Discussions are underway to extend cooperation under the bilateral agreement to other geothermal areas.

A Memorandum of Understanding between the United States and New Zealand is under negotiation. Areas of cooperative study would include drilling and completion, logging instrumentation, chemistry and materials, stimulation, reservoir engineering, two-phase flow studies, and brine disposal.

Activity Highlights/Milestones

The United States will continue to exchange information with Italy, Mexico, and Japan. U.S./Italian brine technology and materials testing activities will be continued and Italian scientists will observe stimulation activities at The Geysers Geothermal Field in California. A conference in Paris will review international geothermal developments.

COMMITTEE ACTION

Geothermal Technology Development—$10.0 million decrease

The Committee reduced the funding for the Geothermal Technology Development subprogram by $10.0 million, consisting of a $7.0 million cut in the Component Development activity, and a $3 million cut which may be spread over the entire Geothermal Technology Development subprogram, as well as the Hydrothermal Commercialization activity, for the general purpose of reducing the budget. The Department is given the discretion to allocate this latter $3 million cut as is deemed appropriate. For purposes of this report, it is assumed that the entire $3 million will be allocated to the Geothermal Technology Development program. The $7.0 million reduction in Component Development is further defined as a $1.5 million cut in Stimulation to defer new explosive stimulation tests and hydraulic fracturing tests for hydrothermal resources; a $3.5 million cut in Energy Conversion to generally reduce the level of effort; a $0.5 million cut in Geothermal Engineering and Materials to reduce the level of effort in qualifying industry capabilities; and a $1.5 million cut in Geosciences to defer new starts in exploration technology and data interpretation.

Within the Energy Conversion activity, the Committee believes that the Sperry Gravity Head Binary Power System has a great potential for achieving very high efficiencies in utilizing geothermal energy. The Committee directs that this System be funded at no less than $3.5 million, which would mean a cut of no more than approximately $2.5 million in the funds presently allocated for this System. The Committee understands that this level of funding will delay implementation of the System from 6–9 months, that is, it is expected to be in operation late in FY 82 or early FY 83.

(d) GEOTHERMAL RESOURCES DEVELOPMENT FUND

The Geothermal Resources Development Fund (GRDF) provides for the geothermal loan guaranty program as authorized under the Geothermal Energy Research, Development and Demonstration Act of 1979 (P.L. 93–410). The purpose of this program element is to accelerate the commercial development and utilization of geothermal energy by guaranteeing loans for resource exploration and development and for design and construction of geothermal energy facilities built by the private sector.

The FY 1981 budget request contains a reappropriation of $41.982 million to account for the proposed deletion of a prior year appropriation language provision that terminates obligational availability of the GRDF for defaults and ongoing administrative expenses after September 21, 1984. Authorization is also requested to change the Contingent Liability Ratio from 1 : 8 to 1 : 12 so that loan authorization can be increased to a total of $550 million, representing an increase of $206 million in FY 1981.

The DOE FY 1981 budget request for GRDF totals $43.266 million, of which $41.982 million is for reappropriation of budget authority, and $1.284 million is for budget authority and authorization for personnel to administer the program. The program direction request has been included with the program direction request for geothermal energy research and development and commercialization program elements. Additional budget authority for the loan guaranty program itself is not required, as that is already provided by P.L. 93–410 as amended.

COMMITTEE ACTION

Geothermal Resources Development Fund—no change

The Committee left unchanged the $1.284 million amount requested for the Geothermal Resources Development fund, recognizing that $193,000 is for program direction and $1,091,000 is for the management of the fund.

2. SMALL-SCALE HYDROPOWER PROGRAM

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses	8,000	8,211		−2,000	6,211
Personnel resources	644	789			789
Total, small-scale hydropower	8,644	9,000		−2,000	7,000

[1] Indicates changes to original FY 1981 B/A request.

The small-scale hydropower program is one of the Department of Energy's industrialization programs designed to develop an existing resource to commercial scale. While the technology is mature, dams that once generated electric power were abandoned because they could not compete with power generated from inexpensive foreign oil supplies. Also, dams that possess the potential for adaptation to power generation were never converted for the same reason.

The main purpose of the small-scale hydropower program is to encourage the private sector to develop available resources to commercial scale. This is undertaken through the following activities:

(1) Creation of an awareness of the resource potential in the private market;

(2) Demonstration of the commercial utility; and

(3) Stimulation of development by minimizing front-end investment risks.

The near-term goal is to encourage developers to achieve up to 1,000 megawatts of power on line or under construction from small hydroelectric projects by 1985. Actions to attain this goal include the following:

(1) Minimizing institutional barriers to development;

(2) Simplifying and shortening the development process;

(3) Provision of federal financial incentives, particularly the Feasibility Study Loan Program and the Rural Energy Initiative;

(4) Improving the economics of hydropower projects; and

(5) Assuring that hydropower projects receive an optimum price for the power produced.

The management philosophy of the program is based on the concept of successively diminishing federal involvement as the commercial scall-scale hydropower program strengthens and grows. This is embodied in the phased development of the federal program, in which the phases have been designed to support hydropower development in the following sequence:

(1) In the first phase, begun in January 1978, DOE in cooperation with the City of Idaho Falls, Idaho, funded installation of turbine generators at the city's existing dams;

(2) The second phase consisted of DOE awarding 54 grants in April 1978, providing financial assistance for feasibility studies of potential small hydropower projects;

(3) In the third phase, seven cost-shared cooperative agreements were awarded in February 1979, to provide up to 25 percent of the cost of installing or improving generating facilities at demonstration projects having a capacity of 15,000 kw or less, and dam heights of not more than 20 meters;

(4) Phase four consists of 15 grants announced in November 1979. Each grant provides up to 15 percent of the cost of installing or improving the generating facilities at existing small dams to produce hydroelectric power. The maximum allowable capacity was 25,000 kw and there was no limit on dam height; and

(5) The fifth phase of the program consists of the implementation of the feasibility study loan program as provided for in the Public Utility Regulatory Policies Act of 1978. The program provides direct Government loans for feasibility studies and licensing expenses for small hydroelectric projects. Loans may be made for a maximum of $50,000 and projects must be at existing dams and have a capacity potential of between 100 kw and 15,000 kw. The loans may be cancelled by DOE if a project is determined to be technically, environmentally, or economically infeasible.

The above phases have been carefully structured to provide a transition from significant federal financial support through to provision of loans for front-end assessment activities. Hence, the burden has increasingly shifted to industry so that hydropower development and projects will not be deferred in anticipation of obtaining future federal grants.

To provide further stimulation of small-scale hydropower activity, construction funds of other agencies have been made available under the President's Rural Energy Initiative Program. Financial assistance will be provided, as appropriate, through the ongoing programs of agencies such as HUD, USDA, and the Department of Commerce. The goal of the Initiative is to provide financial assistance to 100 projects by the end of 1981.

As identified below, a modest parallel activity continues within the DOE small-scale hydropower program that addresses mitigation of environmental and institutional impediments, concludes some key research and development activity aimed toward lowering generating costs, and provides vital outreach activities through the DOE regional offices. The latter outreach provides both information dissemination and assistance in the utilization of the feasibility and construction loan programs.

Significant accomplishments during FY 1980 include the following:

(1) The undertaking of 10 state legislative workshops to assist in state-by-state development of effective hydropower legislation;

(2) Joint sponsorship with the Corps of Engineers of the international small hydropower conference—"Waterpower '79";

(3) Issuance of regulations for and implementation of the small hydropower Feasibility Study Loan Program;

(4) Isslance of 15 cost-shared grants for hydropower construction projects and continuation of the phased cost sharing of the Idaho Falls project;

(5) Initiation of a nationwide outreach program through the 10 Federal Regional Offices; and

(6) Issuance of awards for very low-head engineering development and cost saving techniques.

The FY '81 hydropower program consists of two principal parts—Resource Development and Feasibility Study Loans.

Resource Development

(1) *Commercial demonstrations.*—Support will be continued for the 23 commercial demonstration projects for which commitments have been made in previous years. No additional demonstration projects will be funded. Support will also be provided for the Idaho Falls project, which will go on line in FY 82. Support will continue for the 15 projects awarded in November 1979, and for monitoring the 22 projects awarded in the two competitive solicitations during 1979.

(2) *Legal Impediments.*—Work will continue on reducing legal impediments to hydro development. These impediments are primarily environmental and institutional. For the former, support will be provided to monitor a number of demonstration sites for ecological changes that may result from hydropower development, and to complete investigations into fish passage requirements and water quality protection.

The sum of $1.1 million will be spent on the improvement of institutional requirements for hydropower utilization, such as the licensing and permitting processes. Prior work has identified and analyzed existing impediments and the planned work is intended to eliminate or ameliorate them. This will be done at the state level through the contract with the National Conference of State Legislatures (NCSL). The NCSL will continue its program of holding workshops with the energy committees of state legislatures, in which state laws and administrative practices are analyzed and options for improvements are identified.

At the federal level, substantial progress has been made by the Federal Energy Regulatory Commission in simplifying and expediting the federal licensing process, particularly for small projects and for projects at existing dams. DOE intends to improve the economics of small hydropower projects by promoting improved wholesale power rates pursuant to Section 210 of PURPA.

(3) *Engineering Development.*—Support will be continued for the engineering program at the Idaho National Engineering Laboratory, and for engineering demonstration of the use of pumps as turbines, which is directed at lowering turbine costs. Effort will continue for development of ultra low-head turbines and to test new turbines, and to analyze the application of river basin systems to small-scale hydro development.

(4) *Outreach.*—This is a vital part of the commercialization program. Funds will be distributed to the 10 regional DOE offices to support their work in identifying sites and supporting the Rural Energy Initiative. The regional offices will also support the Feasibility Study

Loan Program by making preliminary assessments of project sites and assisting developers in submitting loan applications.

Feasibility Study Loans

The second principal part of the hydropower program is the Feasibility Study Loan Program. The regulations for implementation of the program became effective February 1980 ("Loans for Small Hydroelectric Power Project Feasibility Studies and Related Licensing," 10 CFR Part 797). Processing has begun for applications submitted in accordance with preliminary regulations, which were not substantively changed in the final regulations. In FY 81, the DOE expects to make approximately 150 feasibility study loans. It is estimated that half of the sites studied will be found technically and economically feasible. Should developers at these sites apply for licensing loans, this can be expected to lead to the development of approximately 225 megawatts of power-on-line.

COMMITTEE ACTION

Small-Scale Hydropower—$2.0 million decrease

The Committee cut $2 million from the Small-Scale Hydropower program to reflect a conviction that existing technology is now available to economically utilize this resource, and that RD&D funds should not be used for proven technology, but should rather be concentrated on developing and demonstrating new or untried technology. The reduction is to be spread over the entire program, with funding preference for the engineering subprogram, which is oriented toward ultra low-head technology development.

I. Electric Energy Systems and Energy Storage Systems

1. ELECTRIC ENERGY SYSTEMS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Power supply integration	16, 900	19, 000			19, 000
Power delivery	18, 300	18, 500			18, 500
Subtotal, operating expenses	35, 200	37, 500			37, 500
Program direction	1, 340	923			923
Subtotal	36, 540	38, 423			38, 423
Capital equipment:					
Power supply integration	100	0			0
Power delivery	700	1, 500			1, 500
Subtotal, capital equipment	800	1, 500			1, 500
Total	37, 340	39, 923			39, 923

[1] Indicates changes to original FY 1981 B/A request.

The share of U.S. energy used to produce electricity has risen steadily in the past and is expected to continue rising in the future. The Department of Energy established the Electric Energy Systems program to ensure that the Nation's electric energy system is capable of meeting future demands reliably with the lowest practical energy losses in accordance with National Energy Policy. The Electric Energy Systems plan takes the systems approach to the domestic electric energy network and ties together energy source and energy end-use technologies.

A research, development, and demonstration effort has been structured to:

1. Improve the efficiency of the electrical energy systems—i.e., increase capacity utilization, reliability, and decrease capital requirements;
2. Develop the system architecture to permit shifting electricity generation away from oil and gas to more abundant nonrenewable resources in the short- and mid-term and to renewable and inexhaustible resources in the long-term.
3. Enhance the efficiency of energy generation, transmission, distribution, storage; and
4. Protect the environment.

The primary focus of the program is on the development of future electric energy systems that utilize centralized (fossil, nuclear, hydro) and decentralized (fuel cells, batteries, photovoltaics, wind small scale hydro, geothermal) sources. Ancillary concerns are to provide delivery options that improve means of transferring energy to meet load and system demands and also to speed up the integration of advanced technologies into a reliable network.

The major thrust of the program is divided into power delivery and power supply integration activities. Power delivery involves development of high voltage alternating current (HVAC) systems, high voltage direct current (HVDC) systems, underground cables, and studies of electric field effects. Power supply integration encompasses systems control and development, load management, and integration of new technologies.

Power delivery focuses on research and development in electric energy transmission. The principal equipment areas (cables, compact stations, overhead transmission electric field effects, and improved system efficiency) have evolved over several years of analysis. The objective for each area is to develop systems that increase power transfer capability while lessening the environmental impact. About 20 percent of the total budget is spent on laboratory and prototype development. In all these phases, DOE encourages industry involvement, including cost-sharing.

The strategy for power supply integration is to ensure that all new sources (including storage) are integrated into the grid system. This is accomplished by developing system methodologies, conducting field tests and technology demonstrations, developing data for power system planning, and transferring information on new source technologies to public and private utilities to encourage the early penetration of these technologies into the electric system.

The diversity and complexity of the issues involved have divided the strategy into two levels of effort: macro or generic, involving the impact of new technologies on the power system, and micro or specific technology-oriented, concerning the actual interfaces on the electric system. Within each, it is necessary to address both near- and long-range problems, all of which encompass considerations ranging from power conditioning equipment to functional models of industry.

The United States electric network is vast and complex. Most experts forecast a rapidly-increasing dependence on electrical energy. This, in turn, will require a higher level of performance from the domestic network. Adding to network complexities will be the introduction of solar and other new sources of electrical energy that are quite different from conventional ones.

The electrical energy system is a vital link between the sources and uses of power. It is so reliable that it is often taken for granted. Both the component elements and operational approach of today's system were designed around large, central-station power plants in an era when growth in scale was the common solution to growth in demand. With the advent of the energy crisis, the nature of the electric energy problem intensified. As this occurred, doubts were raised as to the ability of the Nation to make a smooth transition to an electric energy system using renewable resources and dispersed energy technologies.

The accomplishments in FY 1979 included:

1. With the progress on the development of a gas-insulated power transformer, all key apparatus are under development or have reached the stage of finished prototype equipment tests for

a 1200 kV gas-insulated substation. Some elements are already under test at the Waltz Mill test facility of the Electric Power Research Institute (EPRI), and others at Bonneville Power Administration facilities.

2. An ac superconducting cable test site was completed at Brookhaven National Laboratory. In 1980 the first long section of 100 meters will begin its test sequence. Likewise, an advanced superconducting generator project has completed its laboratory prototype phase and is now in prototype development. Superconductivity is attractive because it combines higher efficiency with smaller size.

3. Construction began on a 4.8 MW fuel cell power plant. Site construction (including all equipment delivery) is scheduled to be completed in early 1980, with the acceptance test initiation set for October of that year. The site is part of the Consolidated Edison Co. system in lower Manhattan; the project is a cooperative effort of DOE with industry and EPRI.

4. A device was developed under contract to the National Bureau of Standards which will analyze non-destructively thyristor crystals prior to fabrication into ac/dc converters. This permits high performance crystals to be selected, thereby increasing conversion efficiency of this key high voltage direct current equipment. This device is now in commercial use.

5. Work was completed on the first phase of the analysis of high voltage electric field effects on living organisms. This effort is more comprehensive than prior work done by universities and industry and is designed to not only determine the effects, but also the genetic reasons for the effects. In process now is further work on small rodents and large non-human primates. This work is under review by several technical peer groups and will be the basis for national standards for high voltage transmission lines.

6. Heating and cooling storage tests began in selected regions during 1979 to determine the system effects of various load management and storage scenarios. The tests will run for two years.

7. Construction of the Battery Energy Storage Test facility began during the year and is now nearing completion. This will become the test site for all advanced batteries for load leveling use on utility systems. It is located on the Public Service Electric and Gas Co. of New Jersey system, and will test DOE and EPRI funded advanced batteries. The first advanced battery (zinc chloride) for load leveling is being purchased and will undergo testing in 1981. This will be about 100 battery modules and represent about one-tenth the capacity of a full scale battery plant for a utility company.

We anticipate the following actions in FY 1980.

1. Initiation of load management/distribution automation system test at TVA.

2. Completion of construction for 4.8 MW fuel cell demonstration and initiation of acceptance tests.

3. Completion of construction of the Battery Energy Storage Test facility and initiation of acceptance tests in the first bay.

4. Starting of electric fields studies on large non-human primates, and determination of need for expanded research on small animals.

5. Completion of cool down tests on a superconducting cable cryostat.

SUMMARY OF COMMITTEE ACTIONS

The Committee left unchanged the Administrttion's request for authorization for Electric Energy Systems.

Referring again to the three elements in this subprogram, the following material summarizes in more detail the planned FY 1981 program:

(a) POWER SUPPLY INTEGRATION PROGRAM

The integration effort will address problems such as the development of control strategies and operating procedures for complex power systems, as well as "technology specific" problems such as developing power conditioning units for photovoltaic devices.

This effort is designed to enhance, as much as possible, the maximum penetration of all of the advanced new sources of electric energy.

Specific areas of activity include:

Load management;
Integration of dispersed generation and storage; and
System development and control.

The plan is to initiate a utility scaled demonstration of load management and distribution automation in the TVA area. This would provide verification of developing models on the effects of dispersed storage and generation on an electric system. It will also give indication of system value (credits) when load management, operational automation and dispersed sources are added.

Specific analysis would be expanded to determine the electromechanical, and other, interactions between dispersed sources and the dynamic electric network. This is necessary for a smooth transition to the introduction of dispersed storage and generation into the existing electric system, and assure proper protection for that system and the equipment as well as the public.

Continued emphasis will be placed to complete the advanced software for automatic generation controls now on test in a utility system, and propogating its use throughout the United States.

(b) POWER DELIVERY PROGRAM

The principal efforts in this program are aimed at the resolution of transmission corridor siting problem and of specific grid-related issues such the effects of electric fields on living organisms. Areas of effort include:

Underground transmission and compact station;
High Voltage Direct Current (HVDC);
High efficiency equipment and systems; and
Electric Field Effects.

The plan is to provide a detailed understanding of the effects of high voltage overhead transmission lines and to provide options acceptable to the public. Therefore, the electric field effects work is basic and will enter the phase of determining the safe levels for humans. Out of this will come national standards. Underground high capacity cables are one of those options. The program is narrowed to three types of cable—(1) ac superconducting, (2) gas insulated, and (3) direct current cables for land and undersea. All look economically viable for various applications.

To make direct current adaptable to reinforce the U.S. alternating current network, a high capacity circuit breaker is required. Emphasis would be placed on this priority item, as well as increasing the efficiency of the ac/dc conversion apparatus.

Progress has been made toward low loss magnetic material for motors and transformers, and will continue into fiscal year 1981. There is potential for reducing losses in these equipments by 50 percent.

(c) GENERATION AND STORAGE APPLICATIONS

The application of dispersed generation and storage devices is important from several aspects. It proves the effects on the system of dispersed rather than only conventional central sources; it develops solutions to institutional barriers preventing industrialization; it allows hands on experience on the operational issues facing the customer and/or utility and enables solution to problems encountered; and it encourages faster deployment of the economically feasible options.

The activities here are funded with pass through dollars. Presently, and in fiscal year 1981, the emphasis will be on the 4.8 MW phosphoric acid fuel cell, and utility storage—batteries, compressed air and underground pumped hydro.

2. ENERGY STORAGE

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Battery storage	32, 000	37, 800			37, 800
Thermal and mechanical storage	30, 840	31, 300		+5, 000	36, 300
Subtotal, operating expenses	62, 840	69, 100		+5, 000	74, 100
Program direction	1, 302	1, 000			1, 000
Subtotal	64, 142	70, 100		+5, 000	75, 100
Capital equipment:					
Battery storage	1, 100	700			700
Thermal and mechanical storage	1, 060	1, 000			1, 000
Subtotal, capital equipment	2, 160	1, 700			1, 700
Total	66, 302	71, 800		+5, 000	76, 800

[1] Indicates changes to original FY 1981 B/A request.

The Energy Storage program includes research, development and demonstration covering the following areas: Batteries, chemical, thermal, mechanical, and magnetic energy storage technologies. These technologies are being developed for transportation, solar energy systems, building heating and cooling, industrial processes, and utility applications.

Program objectives

The objectives of the Energy Storage programs are to develop reliable, inexpensive and environmentally acceptable energy storage systems to:

1. Increase the substitution of coal and nuclear energy for petroleum,
2. Provide continuous energy services from solar and other intermittent energy sources, and
3. Allow more efficient use of electric utility generating facilities.

The resulting fuel substitution will reduce the need to import expensive oil and can help reduce environmental pollution. The increased operating efficiency of utilities can slow the rate of increase in the cost of electricity to the consumer.

Programmatic funding

The funding request is an increase of 7 percent over that provided in fiscal year 1980. The increase will be used to:

1. Increase power and energy density of batteries for electric vehicles.

2. Decrease cost and increase life of batteries for electric utility and solar/wind systems.

3. Procure multi-kilowatt advanced battery modules for testing, and

4. Continue site specific conceptual designs and feasibility and institutional studies for about five aquifer demonstrations.

Accomplishments

During the past year significant progress has been made in the Energy Storage program area. Some examples are:

1. The size of lithium/metal sulfide advanced battery cells has been doubled to over 300 watt-hours—a size appropriate for electric vehicles. Sodium/sulfur advanced battery cells have been scaled up from 15 watt-hours to 200 watt-hours.

2. Contractors have been selected to develop site-specific conceptual designs and aquifer characterizations for seasonal storage demonstrations.

3. A lab-scale module for production of hydrogen by the sulfur/iodine thermochemical cycle has been completed.

4. The efficiency of Redox batteries for solar applications has been increased from fifty to ninety percent and their maximum power has been increased by a factor of four.

5. Cells for aluminum/air batteries have been increased in size by a factor of ten.

6. A prototype of a 45 Wh/kg flywheel regenerative braking rotor has been completed.

7. The National Battery Testing Laboratory has begun operations. Tests on electric vehicle battery cells that exhibit twice the energy density (vehicle range) of current commercial products are underway.

8. Scale model components for a magnetic storage facility for central utility peaking have been tested.

SUMMARY OF COMMITTEE ACTIONS

The Committee increased the Thermal and Mechanical Storage Program of Energy Storage Systems by $5.0 million to permit expanded work in the areas of thermal storage, chemical/hydrogen storage, and magnetic storage.

(a) BATTERY STORAGE

The principal goal of the Battery Storage program is to accelerate by 10–20 years the commercialization of advanced batteries which can meet the requirements of utility load leveling, electric vehicles, and storage for solar energy. Significant milestones are:

1. Test zinc/chlorine, an advanced battery, in at least 2 different electric vehicles in 1980 and demonstrate a range of 100 miles in stop-and-go driving.
2. Transfer the zinc/chlorine battery to the Near Term Battery Program and make it available for participation in EHV Act activities.
3. Specify battery requirements for specific solar applications in 1980.
4. Complete Battery Energy Storage Test facility and initiate testing of the zinc/chlorine battery in 1981.
5. Test Mark II lithium/metal sulfide battery in an electric vehicle in 1983.
6. Test a 25 kWh nickel/iron battery in an electric vehicle in 1980 to evaluate its potential for powering electric vehicles ordered in the 1982 EHV Act demonstration series.
7. Test a 200 kWh load leveling module of a sodium/sulfur battery in 1981.
8. Complete the Storage Battery Electric Energy Demonstration Facility in 1984.

The subprograms within the battery storage program are described below.

Near-Term Batteries

The Near-Term Battery subprogram provides research and testing support for near-term electric vehicle battery systems (lead-acid, nickel/iron, and nickel/zinc) now under development. Testing is performed at the National Battery Test Laboratory. In 1980, a full size nickel/iron battery will be field tested in an electric vehicle. Also in 1980, full size zinc/chlorine batteries will be tested in both compact commuter cars and delivery vans. In late 1980 or in 1981, tests of improved lead-acid and nickel/zinc batteries are expected. Results of these tests together with in-vehicle performance evaluation will be used in FY 1981 to reduce the number of contractors now developing the batteries. To extend cell life and increase active-material utilization, research activities in 1980 will include optimization and control of thermal properties of lead-acid and nickel-zinc cells and electrochemical properties of porous nickel oxide electrodes.

Advanced Battery Development

The Advanced Battery Development subprogram currently includes four battery systems: lithium/metal sulfide, sodium/sulfur (ceramic electrolyte), sodium/sulfur (glass electrolyte), and zinc/chlorine. They are being developed to provide energy storage for electric vehicles, dispersed electric load leveling, and certain solar missions. The zinc/chlorine electric vehicle battery activities are being transferred to the Near Term Battery program because rapid progress has been made in their application to the EV mission. In 1981, the zinc/bromine battery will be incorporated within this program area, assuming that FY 1980 multi-kilowatt test reaffirms the attractiveness of this system for load leveling missions.

The specific objectives of this subprogram are to develop:

1. Advanced batteries for electric vehicles which, for each kilogram of battery weight will deliver 70 watts of power continuously, 200 watts of peak power, and a total of 140 watt-hours of energy, and will result in a vehicle range of 150–200 miles with performance comparable to that of small gasoline-powered vehicles.

2. Low-cost ($35/kWh) and long-life (10-year) batteries for load leveling electric utility systems to displace oil and natural gas used to meet peak power demands, and to permit more efficient and economical operation of utility systems.

3. Advanced batteries suitable for energy storage in photovoltaic and other solar/wind energy systems.

Solar Applications

The Solar Applications subprogram, in coordination with other ongoing battery program efforts, is directed toward the development of long-life and cost effective battery storage systems for the various photovoltaic applications. The storage milestones have been established to coincide with the photovoltaic program objectives. Other solar missions that may benefit from electrochemical storage technology include Ocean Thermal Energy Conversion (OTEC) and Wind Energy Conversion Systems (WECS).

The major emphasis during FY 1980 is to define the specific storage requirements for selected photovoltaic applications so that candidate batteries can be chosen and appropriate development efforts initiated. In order to have appropriate batteries available by 1985, the characteristics of batteries which are best suited to photovoltaic systems must be determined in more detail, particularly for residential applications.

Research in FY 1980 and 1981 will include: (1) development of detailed PV battery performance models; (2) more precise specification of photovoltaic (PV) battery performance requirements; (3) determination of battery cycle life as a function of depth-of-discharge; (4) continued reduction in life cycle costs by reducing initial costs and extending lifetimes; (5) battery testing under actual PV system conditions; (6) initiation of development of a battery operating in the 200–400 volt range and having 10–50 kWh of storage for residential applications. Major developmental efforts are being carried out on zinc-bromine and redox battery systems.

Electrochemical Systems Research

The objective of the Electrochemical Systems Research subprogram is the exploratory development of new, higher performing, simpler, lower cost battery systems. This area supports the electric vehicle, solar, and dispersed electric load leveling missions. The strategy is to develop systems to the point where a decision can be made either to advance a specific technology to full-scale engineering development or to terminate the effort.

Metal/air ambient temperature systems are, at present, the only candidates with the potential to match or exceed the performance of internal combustion engines. The theoretical energy density is much greater than that of the near-term or advanced batteries under development, and therefore, much greater vehicle range may be anticipated. A mechanically refuelable cell will be constructed and tested in 1981.

Supporting Research

This activity supports all of the other battery storage areas. The work is divided into four tasks: (1) exploratory battery research and development—new electrochemical cells and electrode studies; (2) electrochemical engineering research—electrode morphology, phenomological studies, physico-chemical methods for electrochemical research, modeling of cells and batteries; (3) materials research—solid and polymeric electrolytes, stability of passive cell components; (4) studies—safety and environmental studies, availability of materials, uniform costing, commercialization.

COMMITTEE ACTION

Battery Storage—no change

The Committee left the Battery Storage Subprogram unchanged.

(b) Thermal and Mechanical Storage

Thermal and mechanical energy storage technologies are particularly suitable for dispersed applications such as solar/conventional heating and cooling systems (thermal), industrial process heat recovery (thermal) and vehicle regenerative braking (mechanical). Hydrogen serves both chemical feedstock and fuel uses. In addition, these technologies are attractive for centralized storage applications, such as solar thermal power energy storage and compressed air energy storage for baseload coal or nuclear electric plants. Specific milestones are to develop:

1. Seasonal thermal storage in aquifers at a capital cost of \$0.10/kWh(t) for cooling by 1982, and of \$0.02/kWh(t) for heating by 1981.
2. Storage for solar thermal heating applications at a capital cost of \$5 to \$10/kWh(t) by 1982.
3. By 1984, components to retrofit thermal storage components for industrial applications that will provide a 3-year payback period.
4. In cooperation with the International Energy Agency, processes for producing hydrogen from water at a delivered cost of less than \$8/MBTU by 1990.
5. Compressed air energy storage at delivered cost of \$.05/kWh and underground pumped hydro energy storage for solar and conventional power systems by 1985.
6. Composite flywheels with energy density of 90Wh/kg by 1984 for vehicle regenerative braking systems.

The subprograms of the Thermal and Mechanical Energy Storage Program are described below.

Thermal Storage

The specific goals of the Thermal Energy Storage subprogram are to verify the commercial attractiveness of seasonal storage in aquifers (subsurface porous media) for building heating and cooling; and to develop low cost sensible, latent, and thermochemical heat storage components for solar thermal power, industrial heat recovery, solar heating and cooling, and electrical utility load management. The requested budget authority for this subprogram in FY 1981 is \$17,800,000, an increase of \$700,000 over FY 1980.

The FY 1981 budget request will fund site-specific conceptual designs, and the associated feasibility and institutional studies, for as many as 5 proposed aquifer storage projects. These projects will constitute the first phase of a program of detail design, construction, and operations. The second and third phases, to be completed by FY 1985, will include up to three cost-shared projects to demonstrate technical, economic, and environmental viability of this technology on a broad geographic basis.

The FY 1981 budget request also provides funds for the preparation of three conceptual designs and associated feasibility studies for proposed thermal energy storage of industrial process and reject heat for in-plant use. The second phase of this project will include cost sharing for the demonstration including construction, operation, and technology transfer to the commercial sector by FY 1983.

The FY 1981 budget request also provides for continued development of chemical heat pump storage systems, for solar heating and cooling applications, and for customer-side-of-the-meter thermal storage systems for electric load leveling applications.

Chemical/Hydrogen Storage

The goals of the Chemical/Hydrogen Energy Storage subprogram are to develop efficient, cost competitive processes for producing hydrogen from water and to provide the technology for safe and low cost storage, transmission, and distribution of hydrogen. In FY 1981, $2,600,000 in budget authority is requested for this subprogram, a decrease of $1,800,000 from FY 1980.

The requested FY 1981 funding supports electrolytic and thermochemical hydrogen production projects and a market assessment study. These activities correspond to DOE's commitment to the IEA. The FY 1981 request permits continued development of the solid polymer electrolyzer and bench-scale models for testing two thermochemical cycles for producing hydrogen. Other projects previously included in the subprogram are deemphasized in FY 1981 because they do not address immediate near-term requirements.

Mechanical Storage

The objective of the Mechanical Energy Storage subprogram is to develop energy devices that provide improved energy utilization in electric vehicles, facilitate the use of intermittent renewable energy sources for residential and industrial purposes, and substitute for oil and gas-fueled turbines in providing electrical energy during periods of peak demand. The requested budget authority for this program in FY 1981 is $7,700,000, an increase of $1,200,000 over FY 1980.

High performance flywheels are being developed for regenerative braking and load leveling in electric and petroleum-fueled vehicles. In FY 1981, $3,800,000 in budget authority is requested for the flywheel activity. The requested funds will be used primarily to fabricate and test two prototype flywheels for electric vehicles; to continue the evaluation of flywheels for regenerative braking and acceleration assistance when used with either batteries or internal combustion engines; to perform high temperature tests of flywheel components; and to conduct materials and safety tests under simulated operating conditions.

In FY 1981, $600,000 in budget authority is requested for mechanical storage of photovoltaic and wind energy. The objective is to make flywheel systems an economically attractive energy storage option when used in conjunction with intermittent distributed solar electric generators. Their functions will be to provide a basic energy storage capability on a stand alone basis, impedance matching between the solar generation system and electrical loads, and a possible tie with the electric utility. Funds requested will be used for assessments of these flywheel applications, designs and material studies that will lead to cost reduction for the flywheel systems, and completion of a 1/10 scale residential stand-alone flywheel system.

The goal of the underground mechanical energy storage activity is to develop second generation advanced compressed air energy storage (CAES) and underground pumped hydro (UPH) systems. To attain this goal budget authority of $2,800,000 is requested for FY 1981.

Funds requested for CAES will allow (1) completion of work initiated in FY 1979 for preliminary designs and costs analysis for second generation compressed air plants, (2) the development of stability criteria for underground caverns for compressed air storage and (3) thermodynamic, economic, and engineering studies of advanced compressed air storage concepts (fluidized bed combustion, coal gasification, thermal energy storage). Funds requested for UPH will allow (1) completion of cavern stability criteria, and (2) initial analysis and development of more efficient high head turbomachinery. Total market penetration for both compressed air and underground pumped hydro storage is projected to be 100 plants by the year 2000.

The mechanical storage applications activity is a cooperative program of DOE, Electric Power Research Institute, and the utilities. It was initiated in FY 1978 to develop preliminary designs for first generation compressed air storage and underground pumped hydro storage. The preliminary designs, being performed by three utilities and their contractors, include cost analysis, system studies, and specific site evaluations for storage in hard rock, salt and porous media. Utility studies in hard rock and salt domes are due for completion in FY 1980. Funds requested for FY 1981, $500,000, will allow completion of the utility studies of compressed air storage in porous media.

Magnetic Storage

The Magnetic Storage subprogram has two specific goals: design and near-term application of a small storage system to provide utility transmission system stabilization, and development of large-scale electric energy storage systems for long-term application in utility systems. Budget authority of $1,500,000 is requested for this subprogram in FY 1981, an increase of $300,000 compared to FY 1980.

The Bonneville Power Administration (BPA) in a cooperative effort with the DOE is designing and building a 10kWh superconducting magnetic storage device for placement on the BPA system to provide transmission line stabilization. The design of the device has been completed. During peak conditions it will allow 25 percent more (3000MW versus 2400MW) electric power generated by hydro facilities to be transmitted from the Pacific Northwest to southern California to replace peaking power generated by burning oil. Construction which begins in FY 1980 will be completed at the end of FY 1982. This project represents the first use of superconductivity outside a laboratory.

Analytical studies of large (1,000 to 10,000MWh) superconducting storage magnets for utility peaking applications have confirmed they have high (about 90%) potential efficiency and fast (millisecond) response time. The requested funds will be used to continue the search for improved superconductor cables, to develop low cost support structures, to study the feasibility of force compensated magnets that may reduce the requirements for support structure, and to continue design studies with emphasis on maintainability of the system.

Technical and Economic Analysis

The objectives of the Technical and Economic Analysis subprogram are to identify critical needs and market opportunities for energy storage; evaluate energy storage options on the basis of technical, economic and commercial risks, assess the potential environmental impact of storage technologies; and participate in development of commercialization strategies for energy storage technologies. Budget authority of $1,700,000 is requested in FY 1981.

Energy storage research and development needs are evaluated jointly with DOE end-use Divisions because energy storage is a component of a larger system and is dependent upon the system's applications. The Technical and Economic Analysis subprogram characterizes the interfaces of energy storage technologies with end-use applications and analyzes storage system requirements.

COMMITTEE ACTION

Thermal and Mechanical Storage—$5 million increase

The Committee increased operating expenses for the Thermal and Mechanical Storage Subprogram by $5.0 million for the following actities: Thermal Storage: Chemical/Hydrogen Storage; and Magnetic Storage.

The Committee increased thermal storage by $1.5 million in order to maintain the schedule for four demonstrations of heat storage in aquifers. The additional funds are required for the Aquifer Thermal Energy Storage Demonstration (ATES) program, which includes four Phase I Demonstration contracts being initiated in FY 1980. These Demonstrations will play a key role in establishing sound methods to store heat that is now wasted. The Administration's request would not permit full contract activity in FY 1981, or timely completion of Phase I activities in late FY 1982. The increased funding will permit completion of all four Phase I contracts in FY 1982.

The Committee increased Chemical/Hydrogen Storage by $2.1 million in order (i) to accelerate development of the solid polymer electrolysis (SPE) technology for hydrogen production, and (ii) to restore funding for continued development of metal hydride technology for hydrogen storage. SPE is an advanced technology being developed under joint industry and DOE sponsorship to achieve higher efficiency and lower capital cost. Increased funding for SPE development would accelerate work on the 2–5 megawatt SPE system and allow installation of electrolyzer units in an electric utility demonstration as early as 1983. The Committee also recommends maintaining the pace of hydrogen storage activities, particularly development of metal hydrides. In general, the added funding would allow for a level of effort more comparable to that in FY 1980.

The Committee increased Magnetic Storage by $1.4 million in order to provide the DOE share of a joint university/industry, cost-shared project to develop superconductive magnetic energy storage (SMES) technology for electric utility load leveling applications. The first phase of this cost-shared project would address technical and economic issues prior to a decision on whether to build a prototype SMES unit for test and evaluation. The Committee also recommends that the DOE establish an advisory panel of experts from the SMES research community to provide technical liaison with other centers of SMES research and development.

J. Environmental Programs

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Overview and assessment	54, 463	60, 770	−8, 300	−9, 000	51, 770
Environmental research	150, 982	169, 051	−14, 000	−10, 900	158, 151
Life sciences research	40, 500	45, 650	0	−3, 000	42, 650
Subtotal, operating expenses	245, 945	275, 471	−22, 300	−22, 900	252, 571
Program direction	9, 805	11, 133	0	0	11, 133
Subtotal	255, 750	286, 604	−22, 300	−22, 900	263, 704
Capital equipment	15, 300	16, 640	0	0	16, 640
Construction:					
Authorization		6, 400	0	0	6, 400
Budget authority	6, 000	6, 400	0	0	6, 400
Total authorization		309, 644	−22, 300	−22, 900	286, 744
Total budget authority	277, 050	309, 644	−22, 300	−22, 900	286, 744

[1] Indicates changes to original fiscal year 1981 budget authority request.

The Office of Assistant Secretary for Environment was established to formulate and manage for the Department a comprehensive program to assure that the environmental research, assessment, and control issues related to current and developing energy technologies, as well as Departmental operations, are addressed effectively. This program has been designed to meet the specific environmental responsibilities and functions assigned to the Department by the DOE Organization Act (Public Law 95–91) and the generic environmental responsibilities mandated by the National Environmental Policy Act (NEPA) and other environmental legislation such as the Clean Air Act.

The activities are divided into three categories: (1) Overview and Assessment activities which gather information and apply it to specific situations, e.g. the assessment of health effects of synthetic fuels production; (2) Environmental research activities which develop information through basic or applied research useful in policy development; and (3) Life Sciences activities which provide basic understanding of how physical and chemical agents (including radionuclides) interact with living organisms.

The Committee has recommended reductions below the President's original request in all these areas. Detailed explanations for the cuts are explained below under "Committee Action" but the general reasons for each program category are as follows: (1) The assessment activities were cut because they do not seem to be used by the Department in making overall policy; (2) the environmental research activities were cut because there seems to be duplicative and ill-focused work in the proposed program; (3) the Life Sciences research activities were cut because some seemed remote from current Departmental concerns.

Operating expenses for Overview and Assessment, Environmental Research, and Life Sciences Research are authorized in Sec. 118 of the bill. Capital equipment funds are carried in Sec. 119(N), while construction funds are carried in Sec. 120(F). The following program descriptions and recommendations are grouped around the three major program categories—Overview and Assessment, Environmental Research, and Life Sciences Research. The descriptions represent the budget request as presented by the Department.

1. OVERVIEW AND ASSESSMENT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Program element:					
Overview management	5, 795	6, 600	−500	−1, 000	5, 600
Technology impacts	20, 040	20, 800	−3, 100	−4, 500	16, 300
Environmental and safety engineering	18, 760	22, 210	−3, 100	−2, 500	19, 710
Operational and environmental safey	9, 868	11, 160	−1, 600	−1, 000	10, 160
Total	54, 463	60, 770	−8, 300	−9, 000	51, 770

[1] Indicates changes to original fiscal year 1981 budget authority request.

The program to provide environmental support to DOE is designed in accordance with the overall DOE strategy to assure adequate supplies of energy to the Nation's public and private sectors for both near-term use and for long-term needs. Specifically, this Overview and Assessment portion of the program is intended to assure that DOE places adequate emphasis on the environmental, health and safety issues and impacts in the formulation, implementation, and operation of energy policies, programs, and regulations. This responsibility is addressed through the following principal activities in the Office of Environment:

1. Management of the process to assure DOE compliance with the National Environmental Policy Act (NEPA) and other environmentally related legislation and regulations.
2. Management of a program to analyze the energy-related impacts of environmental policies and to assess the potential environmental impacts of energy technologies and conservation measures.
3. Management of the program to provide "independent" overview and assessment of DOE environmental control technologies and policies.
4. Management of the DOE Operational and Environmental Safety program.

These activities are funded through the following four program elements:

1. *Overview management*

The Overview Management portion of the Overview and Assessment program includes all required support for the management and implementation of the program to assure compliance with the National Environmental Policy Act (NEPA) and other environmental legislation, the maintenance of the federal inventory of energy-related environmental research and development, funding for the Environmental Protection Agency's (EPA) annual evaluation of the adequacy of attention to the environmental consequences of non-nuclear energy technologies (as required in Section 11 of the Federal Non-Nuclear Energy R&D Act of 1974), and Office-wide information systems support.

In order to manage Departmental compliance with the National Environmental Policy Act and other environmental legislation (such as the Clean Air Act, Clean Water Act, etc.) the program has been structured to address the following major objectives;

To incorporate environmental protection objectives into the DOE planning process.

To perform specific environmental analysis and assessment concurrent with the planning of specific DOE programs in order to support the implementation of these programs in a timely manner.

To assure that DOE activities are not delayed by external intervention because of failure to involve the public in the environmental review process.

To institutionalize a comprehensive NEPA document review process to coordinate and expedite the responsibility for reviewing and recommending approval or disapproval of specific projects and programs.

To perform analyses and assessments of fully implemented projects and programs to determine the adequacy of compliance with strategies approved to mitigate adverse environmental impacts.

During FY 1980 approximately 240 independent reviews are being conducted to determine the need for Environmental Assessments (EA) and Environmental Impact Statements (EIS). Approximately 125 completed EA's and EIS's will be reviewed and recommendations will be made to the Assistant Secretary for approval or disapproval. In addition, approximately 15 project environmental compliance plans will be prepared and 25 EIS's from other agencies with energy-related activities will be reviewed and evaluated.

During FY 1981, this workload is projected to increase substantially as a result of national energy activities and the implementation of the Power plant and Industrial Fuel Use Act of 1978 (Public Law 95–620). There will be approximately 310 independent reviews to determine the need for EA's and EIS's, 180 completed EA's and EIS's to be reviewed and recommendations for approval or disapproval to be developed, 20 project environmental compliance plans to prepare, and 30 EIS's from other agencies to review and evaluate. During FY 1980, the preliminary DOE Environmental Compliance guide will be distributed to all DOE program management offices to serve as a reference for complying with Federal environmental statutory requirements; the NEPA Action Tracking System is being implemented, a NEPA training program is being established, and procedures developed to incorporate environmental compliance requirements into DOE procurement actions. Also during FY 1980, action has begun to prepare generic environmental report guidelines for prospective DOE bidders.

During FY 1981, at the requested level the program emphasis would be to revise and supplement the DOE Environmental Compliance

Guide to include the State requirements, to issue supplementary DOE Orders implementing environmental planning procedures, to expand the NEPA training program, to enhance the capabilities of the NEPA Action Tracking System, to complete the generic environmental report guidelines for DOE bidders, and to improve the provision of broad based technical and analytical support to the NEPA program management staff.

Also at the requested FY 1981 level, increased program emphasis would be placed on the monitoring of implemented actions for their environmental impact. The emphasis would be integrated into the Overview and Assessment responsibilities of the Office of Environment and be concerned not only with specific mitigation strategies approved in the NEPA review process but also with the broad Office of Environment responsibilities for operational environmental health and safety (EH&S), control technology assessments and analyses, energy technology assessments, policy analyses, and geographical assessments.

The funding requested to support these planned program objectives would be used to increase contractor scientific and technical service support to the increased environmental compliance and NEPA document review workload. The level of funding requested for the other Overview Management elements (maintenance of the federal inventory of energy-related environmental research and development, environmental program evaluation, and Office-wide information systems support) is approximately the FY 1980 level with an adjustment for inflation.

As part of this program element, environmental outreach and coordination activities would be conducted to facilitate incorporation of public participation regarding the Department's policies as they affect the environment. The impact of the proposed FY 1981 budget revision, however, would be to limit these outreach activities.

2. Technology impacts

The goal of the Technology Impacts program is to improve DOE understanding of the impacts of environmental policies, laws, and regulations on energy development and use and the impacts of energy policies and development programs on the environment, health and safety of the Nation. This program is aimed at the policy formulation and program planning aspects of DOE activities.

It is through this program that the Assistant Secretary for Environment (ASEV) obtains principal support for carrying out the following functions delegated by the Secretary: (1) to review and assess DOE policies and strategies for environmental impacts; (2) to prepare DOE policy and legislative Environmental Impact Statements; (3) to review and assess environmental, analytical and technical products prepared by other DOE program offices; and (4) to act as a link to environmental agencies and the environmental community. In satisfying these responsibilities, the Technology Impacts program develops comprehensive analyses and assessments of energy-related environmental, health and safety, social, economic and institutional issues based on information, data and research findings developed mainly by other programs in the Office of Environment (EV).

The intended users of these analyses and assessments are DOE senior officials, other Federal agencies, Congress, States, industrial associations and the environmental community.

The Technology Impacts program is implemented through four elements—Policy Analysis, Technology Assessments, and National and Regional Environmental Assessments—using in-house professional staff, qualified contractors, and national laboratories.

a. *Policy analysis.*—The objective of this program element is to provide short-term analysis of the energy-related implications of Federal and regional environmental policies, laws, and regulations with the goal of supporting DOE decisionmaking. The element provides monitoring and early-warning analysis of significant environmental, health, and safety actions such as regulatory and legislative initiatives by other governmental organizations.

During FY 1979, several regulatory and legislative proposals were analyzed to provide a basis for the DOE position. For example, EPA's recently-proposed New Source Performance Standards (NSPS) for coal-fired steam-electric plants were analyzed to determine their potential effect on energy development. The analysis was the basis for the Departmental recommendations of a sliding scale for control of sulfur emissions and an eastern/western approach based on different coal types.

In FY 1980, the Policy Analysis element anticipates completion of further analysis of air quality matters reflected in proposed industrial NSPS, Prevention of Significant Deterioration (PSD) regulations, and particulate standards governing ambient air quality. Examination of acid rain and long-range transport issues will begin. Emphasis is being placed on analyzing water supply and other environmental issues associated with proposed synthetic fuels production facilities and on toxic effluent and solid waste problems being dealt with under RCRA. A final agreement is expected to be reached between DOE and EPA on procedures for setting environmental standards for new energy technologies. At the requested FY 1981 level, emphasis in this program element would shift heavily to consideration of toxics and solid waste problems. Also, analysis would be expanded to anticipate environmental issues related to synthetic fuels production, and long-range transport of air pollutants would be analyzed in depth to determine the possible impacts of proposed energy development, energy use, and energy facility siting. Pending and existing environmental legislation would be analyzed to determine potential impacts on energy policies and DOE programs. In particular, the regulatory impacts on energy policies of the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Surface Mining Control and Reclamation Act, and revisions to the radiation standards would be explored. Comments on Hazardous Waste (RCRA) regulations and the water effluent guidelines for industrial combustors, petroleum refining, ore mining, and coal mining would be developed. Support to the Environmental Issues Committee would continue and this element would produce new editions of the "Policy Issues Briefing Book" for use by Departmental Secretarial officers. This book provides summaries of the major energy-related facets of environmental laws and regulations. In addition, comprehensive descriptions of significant environmental issues are included with the intent of assisting DOE Secretarial officers in assessing potential impacts on energy programs.

b. *Technology assessment.*—This program element provides a continuing assessment of environmental, health, and safety concerns relevant to energy supply and conservation technologies moving through DOE research, development and demonstration phases. It serves as the principal resources within EV on DOE energy technology development programs, supports development of DOE policy initiatives with respect to energy technologies, and provides information for the preparation of Environmental Assessments and Environmental Impact Statements required by NEPA. Technical inputs from other programs in EV are used extensively as inputs for the work of this program element. The primary products of the Technology Assessment program element are Environmental Development Plans (EDPs), Project Environmental Plans (PEPs), Environmental Readiness Documents (ERDs), and Technology Assessments.

In FY 1979, 30 Environmental Development Plans were developed or updated for major energy programs and technologies; Environmental Readiness Documents were completed for 14 developing technologies and 61 Project Environmental Plans were prepared or updated. Major Technology Assessments completed were the National Coal Utilization Assessment and the Imperial Valley Geothermal Integrated Assessment, and the Phase I Solar Assessments.

In FY 1980, efforts will include completion of the Phase II Comprehensive Solar Assessments and substantial progress on the following assessments: Enhanced Oil Recovery, Enhanced Gas Recovery, Gasifiers-in-Industry, Synfuels, Oil Shale, Solar Power Systems, Biomass Conversion Processes, Socioeconomic Impacts of Geysers, Uranium Solution Mining, and Irradiation of Municipal Wastes, and Advanced Isotope Separation. Technology assessments are being initiated on Industrial Energy Use, Unconventional Gas Recovery, Magnetic Fusion, Transportation, Conservation, Increased Coal Mining and Production, and Oil Shale. During FY 1980, this program also plans to develop or update some 24 EDPs, and 13 ERDs, as required.

At the requested FY 1981 levels, EDPs would be revised and updated for about 30 evolving energy technologies; ERDs would be generated or updated for some 22 technologies; and PEPs would be prepared or revised for 65 to 75 major energy system projects in accordance with the requirements of the DOE project planning management systems. Technology Assessments scheduled for completion in FY 1981 are: Transportation, Conservation, Coal Mining and Production, Solar Energy Systems, Oil Shale, Advanced Isotope Separation, Industrial Energy Use, Unconventional Gas Recovery and Magnetic Fusion. Additional Technology Assessments will be initiated on Biomass Processes, Utility Storage and Laser Fusion.

c. *Environmental impacts.*—The objective of this program element is to assess potential national environmental impacts of energy policies and plans; conduct intertechnology, interregional, and intermedia tradeoff studies and carry out environmental risk, uncertainty, and economic analyses.

During FY 1979, an environmental assessment of a "business-as-usual" energy future projected in the First Annual Report of the EIA was completed and environmental assessments of the National Energy Act and the Second National Energy Plan were prepared. Draft EIS's were also prepared on proposed legislative energy policy initiatives on oil shale and unconventional-gas tax credits, and building temperature controls, as required by NEPA. To improve the validity of these assessments, major efforts were undertaken to improve the analytical capabilities of this program. In addition, the use of uncertainty analysis in forecasting environmental control costs of emerging technologies was demonstrated using oil shale as a test case. A catalogue of available DOE data bases, models, and graphics systems was published for DOE, environmental analysts, and the general public, and workshops were conducted on integrated assessments, ecological systems analysis, and national and regional modeling. An important step was taken toward standardizing analyses with the quarterly publication of an environmental data book for energy technology policy analysis.

In FY 1980, the Annual Environmental Analysis Report (AEAR) and the assessment of the EIA second annual report to Congress will be issued to provide new guidance for policy and research. This program element will initiate a broad-based assessment of the economic impacts of pollution abatement for use in policy analysis and national and regional assessments.

The major tasks to be undertaken at the FY 1981 requested level would involve the preparation of AEAR, impact assessments for the Third National Energy Plan, and the Fourth EIA report to Congress. Simulation models would be used to support special regional and technology assessments as well as policy issue analysis, with particular reference to toxic and hazardous pollutants. In addition, methods for linking long-range air pollutant transport models to simulation model outputs would be developed and tested. Comprehensive estimates of costs and the economic impacts of pollution abatement would be improved and expanded. Prior national environmental assessments which generated significant public and scientific interest and for which improved input data are available would be updated, especially for energy scenarios beyond the year 2000, emphasizing renewable sources, decentralization, and electrification. Continued development of means for conducting national ecological assessments under alternative energy futures would take place.

d. *Regional assessment.*—The objective of this program element is to identify and assess regionally-derived health, environmental, safety, and social issues related to national energy plans and to provide DOE with this information for use in establishing and evaluating DOE policies and programs.

In FY 1979, this element produced, in conjunction with DOE national laboratories, the first annual cycle of Regional Characterization Documents (RCDs) and Regional Issue Identification and Assessments (RIIAs) for each of the 10 Federal regions, as well as an Executive Summary of the RIIAs for use by DOE in policy planning. A Mitigation Strategies Guidebook was also generated for use by DOE and regional officials in considering techniques for ameliorating the effects of specific energy development plans. Several special analyses of regional issues were completed, such as the effect of water supply and use patterns on energy development in water-critical areas of the country.

In FY 1980, this program element will publish the second cycle of both RCDs and RIIAs while developing and using factor analysis and clustering techniques to improve the predictive quality of the models used. In addition, this program will develop appropriate techniques and begin comprehensive assessments or urban and community impacts of major DOE initiatives, including the current synfuels initiatives.

At the level of the FY 1981 request the third generation of RIIA reports on the impacts associated with energy supply/demand forecasts provided by the Energy Information Administration and the National Energy Plan would be produced for each Federal region. An update of the RCDs would be completed and an automated system developed to maintain the currency of these data. The information in these documents would be used to identify issues and areas for case studies. Several mitigation strategy projects tied to selected DOE demonstration projects would then be developed. This element would also develop a structure for formalizing relationships between DOE, regional planning organizations, and state agencies. The assessment of issues derived from earlier RIIA and AEAR reports and from guidance provided by the Policy Analysis program element would be expanded. This would include the development of a concise data base that could be used to reassess the national environmental assessments, and cross-check technology assessments for region-specific issues that might impede the siting of new energy systems. The program to conduct urban and community impact assessments would be expanded to assure informative analysis of the impacts of DOE initiatives.

The impact of the proposed FY 1981 budget revision would be to (a) cancel the technology assessment for biomass energy conversions, (b) not allow updating environmental development plans for some emerging energy technologies (c) delay until FY 1982 the oil shale technology assessment, (d) restrict urban community impact statements to only a few priority cases, (e) delay preparation of regional characterization documents, (f) limit comprehensive assessments to the third national energy plan, EIA forecasts, and highest priority legislative initiatives, and (g) allow no forward-looking analyses of environmental policy issues other than outside-generated regulatory issues.

3. *Environmental and safety engineering*

Responsibilities assigned to the office of the Assistant Secretary for Environment by the Secretary, include developing environmental policy; issuing guidance on environmental, health, and safety legislation; and conducting independent reviews of environmental issues associated with energy RD&D. The Environmental and Safety Engineering (E&SE) program supports the Assistant Secretary (ASEV) by providing her the capability to make independent evaluations of environmental control aspects of DOE's energy research program and National energy policies. E&SE staff have (a) directly contributed to the development of energy program RD&D plans, (b) served on major DOE procurement evaluation boards, (c) served formally as "research coordinators" to enhance the bridge between energy development activities and environmental activites, (d) provided information and expertise to regulatory and policy units including the Economic Regulatory Administration, the unit responsible for the Department's policy on converting oil-fired boilers to coal, and the Federal Energy Regulatory Commission, to which E&SE provided information on LNG issues, and (e) provided feasibility data that served as the basis for energy developers awarding research contracts for further development and demonstration of novel and enhanced environmental control options.

The activities in this program are described according to energy technology: coal; petroleum and gas; oil; solar, geothermal and conservation; and nuclear.

For coal at the requested level for FY 1981 emphasis would be placed on control technology for industrial coal use and on those technologies that convert coal from a solid to a premium liquid or gas. Focus on environmental control implications of electric-power-from-coal would be deemphasized in view of the data base already established, the New Source Performance Standards for utility boilers promulgated in 1979, and the research program now supported by the Assistant Secretary for Fossil Energy. However, key aspects of the electric power system, including the implications of RCRA on coal ash and flue gas desulfurization sludges would continue to be evaluated. Additionally, selected high priority environmental control aspects of coal extraction and preparation operations would be addressed.

Liquefied gaseous fuels (LGF) such as liquefied natural gas (LNG) and liquefied petroleum gas (LPG) represent an important fraction of the Nation's energy resource; however, information must be generated to deal with the generally unfavorable public perception of their hazards. Consequently, there is a need to provide additional information relating to safety and environmental control issues for LGF.

The LPG program has focussed on understanding the fire and explosion hazards resulting from LPG spills. Because there is virtually no previous experience to draw on, a program of graduated tests has been necessary. DOE has started with 6 cubic meter spills, increased to 40 cubic meter spills, and in 1981 would begin planning of larger spill tests (perhaps 400 m^3) based on analysis of results of the smaller tests. In addition to LNG activities described, an LPG marine-terminal safety-assessment has been completed, and preliminary LPG fire tests would be conducted and evaluated in accordance with guidance in the FY 1980 LPG assessment study. In support of the DOE initiatives in enhanced petroleum recovery, at the requested FY 1981 level, emphasis would be placed on environmental control technology implications of heavy oil and tar sand resource utilization, in particular on the ability to burn heavy oil to generate steam in view of the high nitrogen content vs. stringent nitrogen oxide regulations.

In FY 1981, the E&SE environmental control assessment would continue to focus on high priority environmental control uncertainties associated with oil shale operations. A significant accomplishment in FY 1979 was the development of a first order estimate for the range of control costs that would be expected in view of existing and anticipated environmental controls. At the requested level for FY 1981, the ongoing E&SE field studies, initiated in FY 1980, would be expanded to gather confirmatory data on actual sites and on the effectiveness of control systems for gaseous emissions, particulates, wastewaters, and on spent shale stabilization. These studies would provide operating data heretofore not available.

Laboratory studies directed at modified in-situ technologies will continue to provide fundamental knowledge required to gain an understanding of key environmental control issues including (a) aquifer contamination and cross connection, (b) abandoned retort control requirements, and (c) wastewater cleanup requirements. E&SE activities in FY 1979 and FY 1980 have already shown that unique properties of oil shale wastewater may demand operations different from the conventional petroleum wastewater cleanup train.

E&SE programs in the solar, geothermal and energy conservation areas generally must respond to a broad spectrum of issues in a number of rapidly evolving energy technoolgies. For example, the E&SE solar energy program in FY 1981 would be responsive to (a) DOE's gasohol initiative and (b) DOE's biomass program. The solar energy emphasis for FY 1981 would shift from home and industrial solar systems to evaluation of the environmental implications of large, central solar collector systems. In FY 1980, reports on state-of-the-art of geothermal energy liquid waste, hydrogen sulfide cleanup, and noise abatement systems were completed. In FY 1981, data required to better determine control practicability would be collected.

Nuclear energy programs conducted under E&SE should enable the ASEV to provide independent assurance to the Department that (a) adequate environmental controls for DOE nuclear energy fuel cycle program are available or are to be developed by the Assistant Secretary for Nuclear Energy (ASNE), and (b) potential health and environmental hazards at facilities formerly utilized in nuclear operations conducted for the Government have been identified and are or will be eliminated by remedial action operations conducted by the ASNE. In the nuclear fuel cycle program accomplishments include completion of a baseline evaluation of alternative controls for light water reactors (to be published in FY 1980), a preliminary evaluation of controls for thorium fuel cycles, initiatin of control analyses for alternative nonproliferation fuel cycles, and evaluation of fusion reactor control needs.

At the requested level for FY 1981 control evaluations for fission and fusion reactor systems would build on prior accomplishments with new emphasis on the identification of areas where laboratory and field control data should be independently acquired. Planned to continue in FY 1981 is the program to evaluate the environmental control aspects, of high priority DOE nuclear waste management programs. Efforts to acquire independent fuel cycle laboratory and field data identified as lacking in the course of FY 1980 and FY 1981 evaluations will be initiated. Also planned to continue in FY 1981 is the FY 1980 initiative on evaluation of decontamination techniques and associated costs and identification of options for development.

With respect to inactive uranium mill tailings sites critical FY 1979 and FY 1980 ASEV responsibilities mandated by P.L. 95-604 were

(a) reporting to Congress on Contaminated Public or Acquired Lands and (b) completion of the process of designating and ranking mill tailings sites for remedial action. In 1981, at the requested level of support the following 1980 activities would be continued: preparing an Annual Report to Congress on the implementation of the Uranium Mill Tailing Remedial Action Program under P.L. 95-604; conducting radiological surveys of mill tailings sites and adjacent properties; review of concurrence in NEPA documents and remedial action project plans; and initiation of radon monitoring programs at high priority mill tailings sites to determine radiological conditions at sites before, during and at the completion of remedial action operations.

E&SE activities with respect to formerly utilized MED/AEC sites in FY 1981 would be expanded to provide independent radiological surveys and environmental overview and certification necessary to support planning and conduct of remedial actions at high priority MED/AEC sites where DOE has legal authority to perform cleanup.

With respect to surplus radioactively contaminated DOE-owned facilities: E&SE activities in 1981 would provide independent assurance of the adequacy of the Department's program to restore such surplus facilities to conditions that would make them available for safe use. Significant E&SE accomplishments are the completion of decontamination and initiation of certification evaluations at the Gnome Site in New Mexico and the Reactor Building at Santa Susana, California. In FY 1981 E&SE would evaluate and concur in several facility-specific cleanup project plans, and radiological surveys would be conducted before, during and after cleanup operations to certify the acceptability of final conditions. E&SE would conduct radiological surveys to establish final conditions after decontamination of the Sodium Reactor at Santa Susana, California.

The Department's proposed FY 1981 budget amendment would reduce two programs to the FY 1980 level: the E&SE site specific environmental control data acquisition and analysis activities directed at DOE synfuel initiatives, and the E&SE Liquefied Gaseous Fuels program designed to develop technical information and judgments relative to safety and environmental control aspects of handling, storing, transporting and using Liquefied Gaseous Fuels, such as liquefied natural gas (LNG) and liquefied petroleum gas (LPC).

The reduction would be accomplished by deferring aspects of each of these programs to future years. Specifically, in the environmental control program directed at synfuel energy systems, emphasis would be placed on collecting data at the highest priority demonstration sites. For example, efforts would continue on gasifiers in industry, H-coal and solvent refined coal. In the E&SE Liquefied Gaseous Fuels program, completion of the 40 cubic metre experimental field tests would be deferred from FY 1981 until late FY 1982. Analyses of this data would also be deferred. In the interim, judgments on safety and environmental control aspects of handling, storing, transporting and utilizing these fuels will rely heavily on existing data. Plans to conduct large field experiments required to confirm the ability to predict the dispersion and flame propagation behavior of postulated realistic-size LNG releases would be continued, but a reduced level.

4. *Operational and environmental safety*

The Department of Energy owns and maintains one of the largest industrial and research complexes in the nation, employing about 20,000 federal and over 100,000 contractor workers in facilities at some 70 sites. Individual technical program offices have responsibility for environmental, safety and health (ES&H) activities at facilities under their respective cognizance, but the Assistant Secretary for Environment (ASEV) has the responsibility for ES&H overview of programmatic operations at both headquarters and the field. The Operational and Environmental Safety (OES) program assures that the operations and installations of the Department and its contractors comply with DOE policy and other applicable Federal, State and local ES&H policies, standards and regulations. The OES program is implemented through the five elements described below:

a. *Environmental protection and public safety.*—DOE provided the primary emergency response at Three Mile Island and the experience reinforced effort in FY 1980 to assure that DOE radiological emergency plans were in effect at all DOE sites. The Interagency Radiological Assistance Plan was revised in light of the Three Mile Island experience. To implement this plan in FY 1981 additional funds would be needed to improve the DOE ability to render emergency assistance to radiological emergencies in both government and the private sector.

b. *Occupational safety.*—As provided by the Atomic Energy Act, government owned, contractor operated facilities of DOE, are not regulated by the Department of Labor under OSHA nor by the Nuclear Regulatory Commission. This regulation is provided by the Department's operations offices with assurance of DOE-wide compliance by OES staff. In FY 1981 activities would provide baseline data for establishing industrial hygiene guidelines for DOE operations involving substances heretofore unknown or unused in large quantities in industrial processes or the laboratories. In support of the continuing program to reduce radiological exposure to workers in DOE facilities, a project has been established to improve health physics performance, dosimetric methods and equipment, and calibration procedures.

c. *Policy, measurement and institutional standards.*—Establishing ES&H policies for DOE operations and appraising ES&H field activities are the principal functions of OES staff. Assistance in developing ES&H performance measurement systems and standardized procurement procedures to get ES&H provisions in DOE contracts would be increased in FY 1981. Following formulation of an overall DOE quality and reliability assurance (Q&RA) program concept in FY 1980, specific Q&RA policies supporting acquisition of major systems in DOE would be prepared in FY 1981. Guidelines for procurement officials and DOE source evaluation boards would be developed in FY 1981 so that prospective bidders in the major systems acquisition process could estimate the cost of safety requirements. As follow-on to earlier work, safety performance measurements of DOE operations would be further improved in FY 1981 to improve on the uniformity and cohesiveness of the safety programs of DOE operations.

d. *Safety analysis.*—In FY 1980 all DOE technology programs are implementing an OES-initiated safety analysis and review system covering DOE operations. Assurance that these analyses are independently reviewed requires technical safety assessments, which would be provided for priority facilities in FY 1981. In response to the EPA requirement that Federal agencies inventory their toxic materials, particularly polychlorinated biphenyls (PCB), and prepare plans for their safe storage or disposal, mitigation plans for PCB wastes from DOE operations will be developed in FY 1981. It is expected that a disposal method for PCB will be operational in FY 1981. In FY 1981, a study begun in FY 1979 to compile and update safety requirements for DOE nuclear facilities would be the basis of an effort to apply appropriate Kemeny Commission recommendations to the nuclear operations of DOE.

e. *Occupational medicine.*—Many different recordkeeping systems for collecting health related information on DOE workers have evolved throughout the Department. The data is valuable, but it is now widely dispersed and not readily retrievable. The development of a uniform and centralized records system was initiated in FY 1979. With the preliminary design of the system to be completed in FY 1980, implementation on a pilot test basis would be achieved in FY 1981, with Department-wide implementation planned by the end of FY 1983.

The effect of the proposed FY 1981 budget revision would be to delay several planned improvements or end products in specific programs. The major impacts are: efforts associated with improvement of DOE's emergency response capability will be deferred; pilot implementation of the uniform and centralized records system for correlating employee health status with occupational hazards would be deferred, but planning for this program would continue, thus retaining the nucleus of the staff that has been built up in FY 1980; the development of standardized procurement procedures to incorporate environmental protection, safety, and health protection provisions in DOE contracts would be delayed; and specialized advice in support of the Office of Environment's review of the safety analysis effort of major projects would be reduced, but adequate reviews of some major systems acquisition projects would still be possible.

The effect of the budget reduction is to reduce planned improvements in specific programs. However, this program would retain the capability to assure that DOE operations are conducted in accordance with applicable ES&H policies.

2. ENVIRONMENTAL RESEARCH

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Program element:					
Human health studies	27, 090	30, 024	−2, 524	0	30, 024
Health effects biology	47, 075	50, 644	−4, 097	0	50, 644
Environmental studies	35, 220	36, 268	−3, 903	−4, 000	32, 268
Physical and technical studies	31, 205	33, 615	−2, 910	−1, 000	32, 615
CO_2 and climate	8, 950	13, 900	−166	−3, 900	10, 000
Risk analysis	1, 442	4, 600	−400	−2, 000	2, 600
Total	150, 982	169, 051	−14, 000	−10, 900	158, 151

[1] Indicates changes to original fiscal year 1981 budget authority request.

The environmental research (ER) program is structured with the aim of providing DOE managers with the knowledge needed to resolve energy-related environmental health and safety (EH&S) uncertainties and conflicts.

The Department of Energy has the responsibility for leadership in developing an adequate energy supply for the Nation. As part of this responsibility, the Department has stated its commitment to develop energy technologies which are both cost-effective and environmentally acceptable. To support this responsibility, the Office of Environment conducts a technology-oriented EH&S research program which includes human health studies, studies of health effects in biological systems, environmental studies, physical and technological studies, carbon dioxide and climate research, and health and environmental effects risk analysis. This research program is the only Departmental program which plans, funds, and manages a comprehensive research effort to determine the EH&S effects of energy technology developments.

The information and knowledge gained from this research program is intended to provide the basis for alerting energy technology program managers to potential problems in order to avoid harmful environmental effects.

During FY 1980, the principal emphasis of the Environmental Research Program is to determine the biological and environmental effects of coal combustion and conversion technologies, low level radiation, diesel exhaust emissions, and carbon dioxide. The FY 1981 research program would place additional emphasis on effects of coal combustion such as increased levels of carbon dioxide in the atmosphere; coal liquefaction technologies; effects of new gas and oil exploration technologies; solar, geothermal, and conservation technologies; diesel, ethanol and methanol fuel exhaust emissions; and EH&S effects of magnetic fusion and fission technologies.

The Environmental Research Program uses the expertise of a broad array of physical , chemical, biological and environmental scientists to study energy-related health and environmental effects. Although the program is multidisciplinary, research management and funding is organized along disciplinary lines. Technology-related environmental health and safety issues however are addressed by integrated research efforts which cut across scientific disciplines. This program description, therefore, is in three parts: the first briefly describes the program by discipline while the second presents the environmental research effort arranged by the Technology program (e.g. coal combustion, coal gasification, etc.) which it supports. Part three describes by program element and technology the program changes which would be made as a result of the President's April budget revision.

In the President's budget revision in Environmental Research, attention has been given to the anticipated contribution of each energy technology toward meeting the Nation's energy needs. Consideration has also been given to severity and uncertainty of environmental impact and projected time scale for commercialization of particular energy technologies. With these factors as a guide the Department has proposed deferring EH&S research in support of oil and gas and geothermal technologies. As a result of the Department's revision EH&S solar related research would be postponed with the principal exception of photovoltaics. Similarly, fusion related research would be delayed with the exception of studies into the potential biological effects of magnetic field exposure. Additional reductions would be made in work supporting nuclear energy technology and in selected areas of the multitechnology program. Specific impacts of the budget revision are covered in part III.

PART I

1. Human health studies

The objective of this program is to obtain information on the adverse health and genetic effects of energy-related pollutants on selected populations of humans who have been exposed in the workplace or general environment. To accomplish this objective, it is necessary to identify the specific disorders and diseases which are produced by exposure to pollutants; to develop test systems for detection, prevention, and treatment of human health effects; and to determine, when possible, the quantitative relationship of human disease or death to levels of energy-related pollutants. Information obtained in research, medical surveillance and epidemiological studies is used to develop improved work practices and to evaluate the potential impact of energy technology developments on human health.

2. Health effects research in biological systems (Health Effects Biology)

The objectives of this program are; (i) to identify and characterize in rapid, inexpensive biological test systems energy-related pollutants which are potentially hazardous to living organisms; and (ii) to determine the carcinogenic, mutagenic and toxicological effects produced by such pollutants in controlled experimental animal studies. This research program provides the capability of obtaining extensive qualitative and quantitative data on the biological effects produced as a result of acute, subacute, and chronic exposure of experimental animals to known or suspected hazardous chemical agents. In addition, it is possible to determine the manner in which these chemical compounds are converted to toxic or nontoxic forms within the body of the organism. It is generally not possible to conduct investigations using individual pollutants on humans; therefore, experimental animal studies provide the information on biological effects required for extrapolation to humans and estimation of potential risk to humans.

3. Environmental studies

The objectives of this program are to provide information on the distribution of energy-related pollutants in the terrestrial and aquatic environment and their effects on plants, animals and total ecosystems. The research conducted includes defining the transport and transformation of pollutants in water and on land, and identifying the rates of transfer of these pollutants through physical and biological pathways and the accumulation or magnification of these pollutants in the food chains to humans. Effects of pollutants on ecosystems and the rates and mechanisms by which populations and ecosystems recover, accommodate, or succumb to such stresses are determined. The program stresses an integrated approach to these studies; consequently, the research is primarily interdisciplinary in nature, and interacting systems are investigated simultaneously to provide greater insight about the problems addressed than one would obtain from less integrated research. From a basic understanding of processes of transport, nutrient and food chain interaction, and natural population variation, it is possible to predict the impact of one or several developing energy technologies on an ecosystem or on a region.

4. Physical and technological studies

The biological and environmental research to determine the effects and potential impacts of energy-related pollutants is dependent on information and source material provided by this program element which provides the capability of accurate characterization, measurement and monitoring of energy-related pollutants. To obtain the needed information, extensive sampling of process streams, effluents, fugitive emissions, products and wastes from operating technology facilities, is required. Analytical characterization and fractionation of pollutants are carried out, and the fractions are made available to the biological and environmental scientists for pollutant effects research. Research is also conducted to determine the physical, chemical and meteorological processes involved in the transport and transformation of pollutants in the atmosphere, to understand the mechanisms which are responsible for interaction of physical and chemical pollutants with biological and environmental systems, and to develop accurate methods for the measurement and monitoring of hazardous pollutant levels as well as measurement of individual personnel exposures.

5. Carbon dioxide and climate research

Increased concentrations of carbon dioxide in the atmosphere from combustion of fossil fuels poses a potentially serious environmental question. Current predictions indicate a doubling of atmospheric carbon dioxide by the year 2030. Climate models using these elevated levels predict the possibility of significant climatic changes. Should perturbations in the distribution of global temperature, cloudiness, precipitation and wind occur, there could be major changes in global agriculture, in ecosystems, in the biological and physical constitution of the oceans, and in the extent of the cryosphere. The effect of such extensive environmental changes on the international social system is difficult to estimate, but could be large. The ultimate objective of this program is to obtain quantitative information required for a comprehensive evaluation of the potential global impacts of increased levels of carbon dioxide in the atmosphere. To this end, research is in progress to quantify the net sources of carbon dioxide in the atmosphere, to develop a global model of the carbon cycle and to determine historical concentrations of carbon dioxide in the atmosphere. In addition, research is in progress to estimate the effects of elevated levels of carbon dioxide on the character and variation of climatic conditions. In FY 1981, research would be aimed initially at determining the effect of increased levels of carbon dioxide in the biological and physical environments and on the structure of human society.

The climate research effort in this program will continue to obtain data and develop models for determination of the effect of climatic variation on the production, distribution and use of energy resources. In FY 1981 climatic information would be incorporated into a national energy model with the intent of assessing the impact of climate on fossil fuel energy systems. In addition, seasonal forecasts made by most of the major long range forecasting centers in the United States would be collected and verified against the actual seasonal statistics as they are obtained. The program plan also includes the development and maintenance of a data management system for operational purposes, and the continued support of the high altitude sampling program for surveillance of the concentrations and distributions of atmospheric pollutants.

6. Health and environmental effects risk analysis

The objective of this program is to determine the quantative health and environmental impact of energy-technology developments. To accomplish this objective, all current and new data on health and environmental effects associated with technology fuel cycles would be analyzed, and estimates prepared of the potential impact of technology developments. This information would be made available for use in technology assessments and cost, risk and benefit analyses.

PART II

The following paragraphs describe the environmental research program by energy technology with emphasis on activities that would be carried out at the level of 1981 request.

Coal Extraction.—In 1981 activities in this technology element would be on reclamation of strip mining on steep slopes in the East and in arid or semi-arid areas in the West. In addition effort would be expended to develop ways to evaluate the long-term potential of productivity of reclaimed lands.

Coal Combustion.—The core of this technology element would be a continuing research program on; (1) health effects of fine particulates, toxic and noxious gases, heavy metals, and polycyclic aromatic hydrocarbons; (2) the environmental effects of pollutants (e.g. acid rain); (3) the processes involved in the transport, chemical conversion and fate of pollutants released from coal combustion facilities; and (4) the potential global impact of increased level of carbon dioxide in the atmosphere. Data obtained so far seem to indicate that emissions from various coal combustion processes are basically the same and have similar health effects implications. A research program on the health and environmental effects of the combustion of coal-oil mixtures would be implemented FY 1981. In 1981 the carbon dioxide research would continue with significant funds being provided to the National Oceanic and Atmospheric Administration to further develop and refine their program in global modeling. There would also be an effort in FY 1981 to estimate the size and significance of the shallow-water carbonates as a quick-acting sink for carbon dioxide in the ocean. Also at the Department's requested level in FY 1981 historical carbon dioxide records collected by the Smithsonian Institution would be used to try to elucidate the relationship between past global carbon dioxide levels and climatic conditions.

Coal Gasification and Liquefaction.—Several integrated site-specific research projects have been developed to evaluate the potential health and environmental problems associated with coal gasification and liquifaction process developments. The research projects are centered on particular demonstration or pilot plants and have the overall objective of developing the data base necessary for health and environmental evaluations as these technologies are moved toward commercialization. In support of these site and process specific programs, there is also a program of broader research concerned with the evaluation of problems that are common to several fossil energy technologies such as research conducted to determine the distribution and fate in the environment of particulates and of specific organic and inorganic compounds known to be present in emissions. In the area of coal gasification integrated research programs are being conducted at the low BTU gasification site at Pikeville, Kentucky; at the high BTU Hygas project; and work is planned at the Lurgi Gasifier, at the Grand Forks Energy Technology Center, and at the Exxon catalytic gasification process. In coal liquefaction only one pilot plant is being studied at the present time, the SRC plant at Fort Louis, Washington. However, four other plants are either under construction or planned: the H-Coal Plant at Cattlettsburg, Kentucky; the Exxon Donor-Solvent Plant at Baytown, Texas; and an SRC I and SRC II Plant. In FY 1981 at the level of the original budget request acute and chronic animal toxicity studies for SRC I and SRC II products, process materials, effluents, and fugitive emissions would be completed. Preliminary studies on toxicity, mutagenicity and carcinogenicity for similar samples from the H-Coal Pilot Plant will have been conducted and initial results would be reported for samples obtained from the Exxon-Donor Solvent Pilot Plant. A workshop would be held to compare the results obtained from all three pilot plants and quantification of health and environmental effects associated with an installed coal liquefaction industry would be prepared and reported.

Oil and Gas.—A small research effort is being conducted in support of oil and gas technology developments. This includes work on physiological effects on divers, effects of toxic substances on refinery workers, and potential effects of materials used in tertiary oil recovery. Environmental research includes work to develop methods for distinguishing sources of hydrocarbons and effects of drilling fluids on marine organisms. There is also oceanographic work to understand the movement of pollutants and work in Alaska on the effect of oil and gas developments on tundra ecosystems.

Oil Shale.—The production of synthetic oil from oil shale has received a high priority in national energy plans. Oil may be recovered by mining and surface retorting or by in situ retorting. The program conducts research to determine: the health and environmental effects associated with retort abandonment; operational health and safety guidelines; safe solid-waste disposal methods; and waste water treatment systems and emissions control strategies as they relate to the atmospheric transport of emissions from retort facilities. In FY 1981 it is expected that the degree of potency of materials subject to mobilization by groundwater will have been identified and preliminary estimates of risk will have been made. Because controlled combustion of shale will be carried out in a mine environment, in situ shale retorting presents a unique set of working conditions which may require new industrial hygiene and safety procedures to insure a healthy and safe work environment. The development of solid waste management systems is a major issue related to surface retorting but this has been difficult to study because of the unavailability of a surface retorting operation generating large amounts of spent shale. At the requested level in FY 1981 research would continue on field studies concerned with the management of Paraho process oil shale sludge and other solid waste generated by modified in situ processes. Also during FY 1981 DOE expects to have performance criteria established for emission control development and would be engaged in field evaluation of prototype treatment and disposal systems developed by the Fossil Energy Technology Program office.

Solar.—Because solar energy systems are typically material-intensive the development and use of solar technology raises concerns about possible hazards associated with human exposures to toxic chemicals during mining, manufacturing, operation, and disposal or recycle of materials and components. Solar energy systems also might occupy large areas and produce significant impacts on the physical environment and on ecosystems during construction and operation. Work has been conducted to determine the toxicity of over 30 working fluids proposed for use in solar heating and cooling systems. In FY 1981 short term toxicological testing of working fluids would continue as new commercial products are identified. Because of the use of cadmium in photovoltaic cells, FY 1981 would see continuation of a study of cadmium levels in tissues of cadmium smelter workers versus matched control populations. There would also be developed an integrated environmental and health assessment model of the photovoltaics industry. In FY 1981 construction of the central solar collector facility at Barstow should be completed. This would permit start-up of micrometeorological work within the heliostat array to measure direct, diffuse and net radiation; heat fluxes; air, surface and soil temperatures; and wind characteristics. A major oceanographic study has been initiated to determine the effects of operating ocean thermal energy conversion (OTEC) systems on a marine environment. In FY 1981 the establishment of oceanographic baselines at the Punta Tuna OTEC site would be completed. Data would be collected on a triangular grid from the surface to a depth of a thousand meters. In support of the solar power satellite system in FY 1981 the evaluation of the effects of high energy, heavy ionizing particles (atomic nuclei) of solar or cosmic origin will be studied by exposing mice to this radiation.

Geothermal.—Of the three geothermal technologies (steam or hot water for production of electricity; warm water for direct application to heating or processing; and very high pressure, methane-containing (geopressured) sources, only the third is presently limited by technological problems. Development of the first two sources of geothermal energy could proceed rapidly to the limit of the geological resources using refinements of presently available technology if there were not limiting environmental factors. Thus, progress in geothermal development is peculiarly dependent on near-term solution or precise definition and control of certain environmental problems. All of these problems must be addressed by some amount of laboratory research but it is essential that aggressive research programs are conducted in the field. A comprehensive study of the Imperial Valley region has been completed. An integrated study of the transport, fate and environmental effects of effluents is in progress at the only site, Geysers, where geothermal energy is used for production of electricity. Because of the terrain at the Geysers site, the atmospheric studies have been coupled to a broader study of the transport and diffusion of pollutants over complex terrain. These investigations would be completed in FY 1981. Supporting laboratory studies to determine the effects of hydrogen sulfide and ammonia on experimental animals have also been completed. As the field research at the Geysers phases down, an integrated health and environmental research program would be initiated in support of the fifty-megawatt geothermal demonstration plant in New Mexico. A field study would also be initiated and completed in FY 1981 to determine the nature and behavior of cooling-tower plumes in the Geysers area. In addition research would be initiated to address health and environmental issues associated with the direct use of heat from moderate temperature, geothermal resources in Idaho.

Conservation.—Effecting overall reductions in energy utilization mitigates pollution and associated environmental impacts. Nevertheless certain unique pollutants or characteristic environmental alterations are associated with energy-conserving technologies. The efficient transmission of electric power is effected by utilizing higher voltage levels leading to increased exposure to high intensity 60 Hertz electric fields near overhead transmission lines. Studies of rodents exposed to such fields will be initiated in FY 1980 and would continue throughout FY 1981. Also in FY 1981 animal and human models having nonuniform distribution of electrical conductivity would be constructed and employed for thermal measurement of electric fields and currents induced by external 60 Hertz electric fields. Also, testing of an implantable dipole probe in living animals for direct dosimetric measurement would be initiated.

Diesel engines are of interest for conservation reasons because of their high fuel efficiency. To expand the very limited data base on health effects of diesel-related emissions a study was initiated in FY 1979. In FY 1981 all research conducted in this program would continue and a preliminary report of the potential health and environmental impacts of particulates and associated hydrocarbons in diesel-exhaust emissions would be published.

Alcohol fuels are of interest because of their potential for reducing dependence on petroleum. In FY 1981 the information base on regulated exhaust and evaporative emissions from ethanol or methanol fuels would be expanded. Alcohol and aldehyde levels in emissions and the effectiveness of catalytic converters in reducing emissions would be determined.

Burning urban solid waste can both remove an environmental problem and generate some energy. One study underway at Ames, Iowa is evaluating potential health and environmental consequences of processing municipal solid wastes into a fuel and burning this fuel with coal in an electric generating plant. In FY 1981 at the Ames facility work would be initiated on sampling and characterizing organic matter emitted by the generating plant and also on standardized techniques for sampling and measuring microbes in and around the facility. A second solid waste project is investigating the use of anaerobic digestion at Pompano Beach, Florida. Under conditions of steady state operation gaseous, liquid and solid outputs would be characterized, leaching rates of solids and liquids deposited in landfills would be evaluated, and the potential for transport to groundwater systems would be determined. Much emphasis is being focused on the conservation of energy by increased insulation of buildings. In FY 1981 investigations of health effects of fibrous insulating materials such as asbestos and fiber glass would be completed. The development of more energy-efficient buildings also leads to reduction in the rate of exchange between indoor and outdoor air causing accumulation of indoor air pollutants such as carbon monoxide, oxides of nitrogen, and respirable particles. Data are being obtained in two ongoing studies that will contribute to an overall evaluation of potential health risks associated with such increased pollutant levels. In FY 1981 research would obtain quantitative data of the type needed to improve estimation of indoor radon levels and other pollutant levels generated by combustion appliances, and the associated population exposures.

Fusion.—The magnetic fusion energy program has reached a point where health and environmental impacts of fusion reactors could be considered. A possible problem is the existence of large amounts of tritium at an operating plant. In FY 1981 research would determine the lowest tritium exposure levels at which sensitive cell populations are significantly effected and the quantitative dose response relations would be determined and compared to a dose response relationship for chronic low-level exposures to X- and gamma rays. There will also be research on the transport of tritiated water through ecosystems. Another potential problem arises from the use of very high magnetic fields in fusion reactors. In FY 1981 developmental and genetic studies would be completed and new experiments to determine quantitative responses would be initiated if any biological effect is determined to be dependent upon exposure to magnetic fields.

Fission.—The future role of fission technology is critically dependent on the resolution of key environmental health and safety issues. In broad perspective these issues can all be related to the capability for carrying out evaluations of: (1) the actual or anticipated low level radiation exposures of workers and the general population from routine operations of nuclear facilities and from nonroutine but credible operations or accidents such as Three Mile Island; (2) the risk to human health associated with such exposures; and (3) exposure to emergency situations such as what might have developed from the incident at Three Mile Island. Radiation effects have been characterized quantitatively at relatively high exposure levels but quantitative data cannot be obtained readily at low levels in either experimental animal or epidemiology studies. As a consequence it is necessary to extrapolate high dose effects obtained in epidemiological studies and experimental animals to low levels of exposure and to use the results of experimental animal research for estimation of human health risks. In FY 1981 at the Department's requested level much of the research now devoted to the development of methods for the measurement of plutonium and other transuranic radionuclides in environmental media and in the human body would be completed. Research would then be directed to the application of similar techniques for measurement of other actinide elements; notably radium, thorium and uranium which will be relevant in the development of other nuclear fuel cycles and in the assessment of radiological impact of other non-nuclear energy technologies which cause the redistribution of naturally occurring radionuclides in the environment (e.g. radionuclides contained in coal and emitted through fly ash etc.). New initiatives would be undertaken in the development of dosimeteric techniques for beta and neutron fields where existing techniques are not yet satisfactory for the accurate measurement of dose to radiation workers.

An integral part of the DOE program in nuclear waste storage and disposal is the development of information on the environmental transport and fate of nuclear waste materials which is carried out in this research program. In addition former nuclear testing areas and contaminated facilities must be evaluated as to their present radiological health status. The major objective of the ecological research program in support of nuclear technology at present is to determine the pathways of radionuclides through the environment to man. In FY 1981 the definition of the radio-ecological problems associated with technitium-99 would be completed. Increased emphasis would be placed upon the identification of the chemical and biological mechanisms and rates of mobilization of the transuranic elements in the environment. New initiatives would deal with incorporating the accumulated information on the actinide elements and to models of their transport and fate. Radiological and chemical physics programs are directed towards investigations into the fundamental physical mechanisms of radiation interactions in biological systems and development of descriptive theories that permit the prediction of radiobiological effects. New initiatives at the FY 1981 request level would include a project to investigate reproductive toxicity (mutagenesis and teratogenesis) in long-lived mammals to reduce the uncertainty now associated with interspecies comparisons. Further studies would facilitate integrated evaluation of the mechanisms of skeletal, marrow and liver risks in small rodents and beagles. A new study would test the hypothesis that humans with immunological disorders are much more susceptible to the lukemogenic effects of radiation. The biological and environmental research program also supports a limited number of epidemiological studies to provide information on radiation effects in humans. There are also continuing studies of Japanese atomic bomb survivors. In FY 1981 new research would be directed toward health effects associated with the commercial mining, milling and fabrication of uranium and the preliminary findings on the health of workers exposed to plutonium would be published.

Multitechnology.—Environmental research serving more than one technology is carried out in this program. That is, this research provides baseline information required in support of several new and existing technology developments. Pollutants investigated are common to several different technologies. These include air- and water-borne particulates, specific organic and inorganic compounds, and thermal effluents from electric power plants. For example, research in the atmospheric sciences program is focused on the transport and fate of pollutants in the atmosphere in relation to meteorological variables and the topology of the area over which the transport is occurring. Research conducted in the terrestrial portion of this program provides information on natural ecosystems in different geographical regions (subpolar, arid, semi-arid, and humid regions) where energy operations may produce environmental effects. In FY 1981 the Marine Research Program will be reduced by $1.5 million from the current level of effort. The reduction will allow for additional resources for other higher priority research programs which have a more direct relationship to short term energy policy issues. Research emphasis will be shifted to the near-shore frontal zone to provide information on transport and chemical modification of trace elements and other pollutants in this zone and movement of pollutants across this front. Since biological productivity is highest in this area of the ocean, the role of food chain organisms in the dispersion and cycling of pollutants will also be determined.

A portion of the aquatic program includes investigations to determine environmental hazards associated with increased levels of temperature, chlorine, metals and their by-products which result from discharge of cooling water from power plants. Studies of environmentally-caused disease in fish will be completed and the final report will be submitted on the interactive effects of chlorine temperature in copper on acquatic populations. An assessment of the effects of temperature on marine intervertebrate larvae will also be completed and reported. An essential first step toward achieving a definition of health and environmental effects from energy activities is an accurate description of emissions and effluents. The wide scope of energy activities and their changing nature dictates a continued search for improvements in pollutant measurement capability. The multitechnology program includes research for the development of instruments and techniques with improved sensitivity and selectivity of measurement. For example, in FY 1981 the development of advanced laser systems and resonance-ionization spectroscopy would be accelerated to make this technique available as a practical measurement tool. Another example: there is no evidence positively identifying mutational change in humans caused by radiation (or any other pollutant) because there is no technique for the detection of such genetic changes. For this reason the multitechnology program conducts research to develop and apply such new techniques for monitoring mutation rates in human populations.

PART III

This section describes by technology and program element the impact of the President's downward revision of the Environmental Research budget for FY 1981.

Oil and Gas.—The President's budget revision would terminate this program. In the Human Health program element a $524,000 reduction in oil and gas projects would result in (1) termination of work on health effects of pollutants on petroleum refinery workers and their families; (2) elimination of research on a battery of tests to detect precancerous lesions and genetic damage; and (3) termination of data collection pertinent to safety and health of divers involved in oil drilling on the Outer Continental Shelf. In the Health Effects Biology program element research ($168,000) on toxicity of materials used in enhanced oil and gas recovery would be deferred to future years. The Environmental Studies program in oil and gas ($1,048,000) would be eliminated. Since other agencies are funding oil and gas research, DOE projects would be eliminated completely. In the Physical and Technical Studies program element development of prototype offshore oceanographic instrumentation for real time measurement of ocean currents and other oceanographic parameters would be terminated ($506,000).

Solar.—In the Health Effects Biology program element research solar heating and cooling of buildings, solar satellite power systems, and biological damage produced by solar radiation would be eliminated ($692,000) because the research addresses impacts that are associated with long-term technologies or that are not likely to result in serious health problems. Research related to solar photovoltaic technologies would be continued at reduced levels because serious health problems would not be expected during the near term. Environmental studies on Ocean Thermal Energy Systems would be curtailed and Solar Thermal Power Systems would be eliminated for the time being since the development of these systems is projected well in the future; thus the environmental studies can be postponed temporarily ($800,000). A reduction of $400,000 in solar Risk Analysis assessments would eliminate health and environmental risk analysis of solar energy, except photovoltaics. Minimal to moderate environmental impacts are anticipated from those solar technologies on which environmental work will be deferred.

Geothermal.—This program would be terminated. All environmental research in geothermal related studies ($680,000) is to be eliminated. Environmental studies have already been carried out in areas such as the Imperial Valley. Since the estimate of the contribution of geothermal energy to the total energy production is expected to be minimal, it was considered more prudent to support environmental studies in other, more urgent areas of energy development with the funds available for environmental research. In the Physical and Technical Studies program element planned research at the Baca 50 MWe geothermal demonstration facility would be delayed until FY 1982 and atmospheric transport research conducted in the Geysers would be brought to an early completion during the present fiscal year ($1,343,000).

Fission.—In the Human Health program element a reduction of $1,200,000 in the nuclear fission (low level ionizing radiation) program would reduce and slow the work to determine health effects in radium and plutonium workers and delay analysis of late effects of external radiation. Reductions in the health and mortality research on DOE and DOE contractor employees would curtail mortality analysis. In the Health Effects Biology program element all research concerning effects of ionizing radiation on viral replication and immune responses in biological systems would be eliminated. Effort would be reduced in research on health effects of heavy ionizing particles, studies specifically related to breeder reactor systems, research on radiation chemistry aspects of radiobiological damage, and other studies of a short-term nature ($2,242,000). Research directly related to the human low-dose radiation problem would not be impacted.

Fusion.—All fusion related Health Effects Biology research ($904,000) concerned with tritium toxicity would be eliminated because of the long-term nature of anticipated hazards and because reasonably good capabilities for predicting tritium health effects exist. Because this technology is not anticipated as a major energy resource in the near future, the Environmental Studies efforts would be postponed ($485,000) and protracted over the next several years. In the Physical and Technical Studies program element research on dosimetry systems for magnetic field measurement would not be continued beyond the present fiscal year ($351,000). Finally, in the CO_2 and Climate Research program element the revised budget would delay the fusion related program ($166,000) which deals with questions of long distance transport of tritium, tritium measurement technologies for identifying low levels of tritium in the atmosphere, and transfer of tritium from the atmosphere into the oceans.

Multitechnology.—The impact of a reduction of $800,000 in multitechnology Human Health programs would be the following: (1) termination of work on the effects of energy-related pollutants on human surrogates; (2) elimination of biochemical and morphological (structure) measurements on human surrogates after exposure to controlled amounts of inhaled or injected pollutants. In the Health Effects Biology program element generic research on cancer virus and genetics on a strain of mutant mouse not closely related to near-term energy technologies would be eliminated ($91,000). In the Environmental Studies program element, the revision would result in a 15% decrease in operational funds for the National Environmental Research Parks. Research on the effects of cooling water discharges would be curtailed. In the Physical and Technological Studies program element meterological studies in the Great Lakes region would be phased out to preserve efforts underway in the more energy-impacted northeast. Development work on atmospheric transport models would be stretched out. Development of improved techniques for particulate and chemical measurement would be decelerated ($710,000).

In summary, the President's budget revision would have the following impact on the Environmental Research Program: (1) the Oil and Gas and Geothermal programs would be terminated; (2) the Solar and Fusion programs would be greatly reduced (Solar from $2.6M to $0.8M; Fusion from $2.8M to $0.9M.); (3) the Multitechnology program would be cut 10% and the Fission program would be cut 5%

3. LIFE SCIENCES RESEARCH

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Program element:					
General life sciences	22,910	25,650		−4,000	21,650
Nuclear medicine applications	17,590	20,000		+1,000	21,000
Total	40,500	45,650		−3,000	42,650

[1] Indicates changes to original fiscal year 1981 budget authority request.

Life Sciences Research (comprised of General Life Sciences and Nuclear Medicine Applications) is one part of the Basic Sciences activities of DOE and as such generates basic information in support of the Department's environmental programs. General Life Sciences research provides the fundamental basis for understanding how physical and chemical agents interact with living organisms particularly at the subcellular and molecular level. The Nuclear Medicine Applications program is the world's only focussed research and development effort for the beneficial application of radiation and radionuclides in clinical nuclear medicine for diagnosis and treatment of human diseases.

1. General Life Sciences

The General Life Sciences program element provides the fundamental basis for understanding and estimating the risk to human health and impacts on environmental systems of energy-related activities.

The information developed in this program underlies and supports the Environmental Research efforts which are in direct support of the various DOE energy technology developments. The objectives of this research program are to understand (1) the basic structure, function and interrelationships of all key components of living organisms, and terrestrial, fresh water and marine ecosystems; (2) the development of basic information in chemical physics for understanding of the action of energy-related pollutants on biological material and (3) the development of rapid, automated, high-resolution instrumentation and techniques for use in biological and environmental research. The objectives are accomplished through a coordinated program of research performed at national laboratories, universities, hospitals and specialized biomedical laboratories.

The operating funds requested are $25,650,000, an increase of $2,740,000 over FY 1980. This increase would be used to expand selected ongoing research efforts in biological studies of genetic material of the cell nucleus, structural studies of a newly discovered form of DNA and immunologically important proteins, and for the development of a cellular and tissue model for study of the toxic and malignant effects of energy-related pollutants. New initatives would include biochemical studies of scavenger cells (macrophages), the metabolism and effects of organometallic compounds and new mechanisms for the repair of damaged genetic material. Under instrumentation and chemical physics, research would be expanded for fundamental studies on the biophysical mechanisms of the interaction of cells with toxic materials. A new effort would be initiated to develop fast response X-ray detectors designed for studies on the structure of molecules at the National Synchrotron Light Source Facility.

2. Nuclear medicine application

The major objective of this program is to support research and development of new applications of radiation and radioisotopes for the diagnosis and treatment of human disease and the transfer of nuclear technology to clinical medicine. Nuclear medicine examinations are important in the diagnosis of abnormalities and diseases of the heart, lung, liver spleen, kidneys, central nervous system, skeleton, and other organs and tissues within the human body. In addition to providing static organ pictures, nuclear medicine techniques are being used to determine normal and abnormal organ function. These types of examinations include studies of heart actions, assessments of thyroid and kidney function, early detection of transplant rejection, and determination of total blood or plasma volume.

Noteworthy accomplishments have included the production of carbon-11, nitrogen-13, and fluorine-18 for labeling biochemical compounds for investigating possible early detection of cancer, heart disease, brain disorders, and other metabolic abnormalities using newly-developed ring tomograph instruments. Routine synthesis of fluorine-18 labeled deoxyglucose will allow full exploration of the clinical utility of glucose metabolism in brain disorders. Efforts would be expanded in FY 1981 on research, development and clinical feasibility testing of new positron-labeled radiopharmaceuticals for use in tomographic studies for the diagnosis and treatment of human disease. In FY 1981, major emphasis would be placed on advancing capabilities to visualize organ function and disease progression using computer automated tomographic scanners.

In addition to the radioisotopes effort, FY 1981 would see an expanded program in which high purity stable isotopes of carbon, oxygen, and nitrogen are being produced for use in medical, biological, and agricultural research. Stable isotopes are particularly useful for diagnostic procedures on infants and pregnant women because of the absence of any radiation. Compounds labeled with stable isotopes such as carbon-13, nitrogen-15, oxygen-18, were synthesized and provided to research investigators through the National Stable Isotopes Resource, a joint NIH–DOE program.

4. PROGRAM DIRECTION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Program direction	9, 805	11, 133		0	11, 133

[1] Indicates changes to original fiscal year 1981 budget authority request.

This request of $11,133,000 represents the salaries and benefits of the staff of the Office of Environment. It accounts for 234 full time permanent positions and 11 others. This relatively small staff manages the large out-of-house contract program and provides staff support, such as NEPA review, to the Assistant Secretary.

5. CAPITAL EQUIPMENT AND CONSTRUCTION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Capital equipment:					
Overview and assessment	1, 900	2, 040	-------------	0	2, 040
Environmental research	11, 900	11, 700	-------------	0	11, 700
Life sciences research	1, 500	2, 900	-------------	0	2, 900
Total capital equipment	15, 300	16, 640	-------------	0	16, 640
Construction (authorization and budget authority): Environmental research (total)	6, 000	6, 400	-------------	0	6, 400

[1] Indicates changes to original fiscal year 1981 budget authority request.

1. *Capital Equipment*

For the Overview and Assessment program two kinds of equipment are requested for 1981. For the assessment-type activities data handling equipment is needed while the engineering activities require instrumentation.

The assessment activities require the inputting, accessing, storing, manipulating, integrating and displaying of environmental and safety data by means of a wide range of central processors, storage devices, input/output equipment and terminals. Graphic displays, an important management tool for visualizing such things as geographical distributions, etc., are made possible by the use of digitizing equipment which can scan maps and enter data from them into a computer. Once in the computer in digital form the data can be combined with other data to produce the most helpful information display. The equipment would also be used to facilitate utilization of laboratory research results.

The Environmental Safety and Engineering program requests test equipment and measurement instrumentation in order to support assessments of the efficacy of control technologies. There is also a request for instrumentation in support of surveys of radioactively contaminated excess MED/AEC installations and inactive uranium mill tailings sites. The Operational and Environmental Safety equipment needs are primarily for aditional and replacement equipment to enable them to respond to radiation emergencies. This would include radiation detection and monitoring equipment, data-handling equipment, and mobile platforms e.g. aircraft and all-terrain vehicles. In addition certain laboratory equipment is needed to support the LPG fire research test program.

For the Environmental Research Program the capital equipment request reflects a small decrease from FY 1980. Capital equipment is essential for pursuing the diverse program of research on health and environmental effects of the numerous energy technologies under consideration. Each aspect of this research requires specialized and sophisticated equipment. Of special need is equipment to be utilized in studies on low-level radiation exposure of humans, the potential impacts of increasing carbon dioxide concentrations in the atmosphere, and diesel exhaust emissions. The necessity to maintain state-of-the-art capability and to replace older instruments, whose continued use and operation is no longer cost effective, also supports this request. Equipment requested includes items such as spectrometers, portable diesel generators, growth chambers, carbon dioxide incubators, pulsed X-ray systems, and refrigerated centrifuges. The vast majority of these items cost less than $50,000, but are of great importance for carrying out research efforts.

The capital equipment request for the Life Sciences Research Program represents an increase of $1,400,000 above the FY 1980 level. This increase is important to the quality of research carried out in this program because the availability of equipment funds in prior years has been inadequate in comparison to the requirements for these studies.

Much of the equipment request is for replacement of equipment which is needed to continue high quality research supportative of health and environmental efforts, including such items as fluorescence detectors, spectrophotometers, fluorimeters, counters, spectrometers, liquid chromatographs, and scintillation probes.

Capital equipment funds are also requested to support the proposed biological beamline at the National Synchrotron Light Source (NSLS) Facility. The outstanding increase in beam intensity would significantly extend the current program investigating structure of large biological molecules, and would provide a unique opportunity to study structure-related functions.

The intensity provided at the NSLS would enable studies on much smaller amounts of material, a significant advantage since biological materials of interest are frequently available only in minute quantities. In addition, studies can be performed much more rapidly, which offers the unique opportunity to study structural changes over time periods as short as milliseconds thus opening a completely new realm of structure-function interrelationships.

This research would not only extend our understanding of the role that biological structure plays in normal biological processes, but also would materially advance our understanding to the way in which pollutant materials may modify these normal biological processes. The total cost of the biological beamline is $1,500,000 with $700,000 requested in FY 1981 and the balance in FY 1982.

2. Construction

Construction funds are requested in support of the Environmental Research Program. The request covers general plant project needs of $3,000,000, a biomedical laboratory addition at Lawrence Berkeley Laboratory ($1,400,000), and the modernization of laboratories for study of environmental pollutants at Oak Ridge National Laboratory ($2,000,000).

COMMITTEE ACTION

Environmental Programs: Redirect and cut $600,000

The Committee has adopted a budget level of $286,744,000 for the Environmental Programs of the Department of Energy, which compares well with the President's revised request of $287,344,000. As shown in the Bill, this budget includes the three substantive program categories (Overview and Assessment, Environmental Research, and Life Sciences Research); it includes salaries under Program Direction; and it includes funds for capital equipment and construction.

Environmental Programs were reviewed in the Subcommittee on Natural Resources and Environment which arranged a series of briefings on DOE programs beginning in the Fall of 1979 and held hearings in February 1980 on the President's budget. The original budget request (submitted in January, 1980) was thoroughly analyzed upon delivery to the Committee. Subsequently, the President delivered a revised budget request (April, 1980) which contained substantial reductions from the original request. The point is that the reductions made by the President were in the categories that the Committee analysis had found to be "softest" and in amounts similar to cut that the Committee was contemplating based on its own independent analysis. It should be pointed out also that the Committee funding level of $286,744,000 compares favorably with funding of $283,500,0000 for this area as derived from the Budget Committee's report.

A second point that should be made is that compared to the FY 1980 levels, only one Program, Overview and Assessment, has actually been cut. All the others show at least small increases over 1980. Reasons for the cut in Overview and Assessment are discussed below.

The following paragraphs describe the Committee actions in more detail with respect to each program and program element.

The Committee recommended that the Overview and Assessment Program be funded at a level of $51,770,000 which is $700,000 below the President's revised request and $9,000,000 below the President's original budget request. This figure appears in Section 118(A) of the bill.

The Overview and Assessment Program is composed of four program elements: Overview Management; Technology Impacts; Environmental and Safety Engineering; and Operational and Environmental Safety. A large part of this program is concerned with studies and assessments related to the environmental impact of energy development. The Committee cut these areas in response to its own analysis and to criticism in various reports. For example, a study done by the General Accounting Office says "The Energy Department's Office of Environment does not have a large role in decision-making." The principal finding of this report was that most of the Energy Department's decisions are made without substantial input from the Office of Environment. A second report was the Environmental Evaluation Report to the President and the Congress required under Section 11 of the Federal Nonnuclear Energy Research and Development Act (Public Law 93-577). This report made criticisms similar to those of GAO, saying, in part "it is not clear what formal environmental criteria, if any, DOE uses as a basis for project reviews and priority settings." Findings such as these have been corroborated by testimony at our hearings.

For example, one witness said that some of the studies and reports developed in this program are not utilized in DOE policy-making and that the success of the program "is not nearly so dependent on the existence of a large funding base. A small but adequate headquarters staff and cooperation from other elements of the Department are the prime requirements for success in these areas." In addition, this Program was purportedly responsible for environmental input into DOE's oil-to-coal conversion policy, yet hearings before the Subcommittee revealed that this policy does not take account of environmental concerns in a meaningful way. It should be pointed out here that the funds for personnel in this program were not cut by the Committee (these are carried and discussed below under Program Direction).

The Committee recommended that the Overview Management program element be funded at a level of $5,600,000; $500,000 below the President's revised request and $1,000,000 below the original request. The Committee does not intend that this cut impact the Department's NEPA review activities carried out in this program element nor the funding for the Section 11 report. The Committee believes that the level of funding recommended is adequate for the program to have a major impact on DOE policyl-making (to assure that energy supply technologies are environmentally sound) if the activities are well-managed and if the Department intends to honor environmental considerations. The recommended cut would reduce the level of contract support for this program.

The Committee recommended that the Technology Impacts program element be funded at a level of $16,300,000; $1,400,000 below the President's revised budget request and $4,500,000 below the original budget request. The criticisms in the Section 11 report and in the GAO study as well as in the testimony at the hearings apply to this program element and, therefore, the Committee made substantial cuts in this area. The Committee believes that it is very important for the Nation's Energy Development programs to proceed in such a way as to assure the implementation and commercialization of environmentally sound technologies, but the information made available to us indicates that not all of the activities in the Technology Impacts program element have contributed to such assurance. The funds requested are all for contracted work which would generate large numbers of reports of unknown usefulness. The Committee believes that this budget reduction will not in any way adversely impact the Department's ability to insure the development of environmentally sound energy supplies.

The Committee recommended that the Environmental and Safety Engineering program element be funded at a level of $19,710,000, which is $600,000 above the Persident's revised budget request and some $2,500,000 below the President's original request. Because this program element provides the Assistant Secretary with the capability to make independent evaluations of environmental control aspects of DOE's energy development program and national energy policies and is, therefore, clearly of major importance, the Committee did not feel that its budget should be reduced as much as the President had recommended. In particular, the Committee recommends that the Liquified Gaseous Fuels Fire Safety activities not be reduced as much as had been contemplated.

The Operational and Environmental Safety element, recommended to be funded at a level of $10,160,000, is $600,000 above the level in the revised presidential request. It is $1,000,000 below the original presidential submission. Because of the immediacy of the needs in this area and because this program provides a certain amount of real experience with environmental control and safety situations, the Committee did not feel that this budget should be reduced as much as the President had recommended, especially in the employee's health records project.

The Committee recommended that the Environmental Research Program be funded at a level of $158,151,000, an increase of $3,100,000 over the President's revised request but $10,900,000 below the President's original request. In this program, the general thrust of the Committee is to preserve the most important research work (which is that work related to human health) while reducing areas that seem to be duplicative or more qualitative and subjective (i.e., "soft"). These funds appear in Section 118(B) of the bill.

The Human Health Studies program element is recommended to be funded at a level of $30,024,000 which is exactly the level of the President's original request for this program and is $2,524,000 above the President's revised request. The Committee feels that information gathered in this program will be very helpful in insuring environmentally sound energy technologies. The Committee felt that the major thrust of the DOE Environmental program must be the avoidance of human health impacts that might otherwise be caused by the development of energy technologies. It seems foolish to cut these studies because of a short-term need to reduce the budget when one knows the information will be needed in the near future. If some of these health programs are terminated now, it will be difficult to start them again because the research teams will be dispersed. If health effects information is needed in a few years as energy technologies approach commercialization research must be conducted now and the teams must be kept intact. As a specific example, the President recommended that an epidemiological study of oil refinery workers be terminated. The Committee disagrees, believing that, for example, such a study could provide valuable information regarding a future synfuels industry. Similarly, the studies of health effects of radium and plutonium workers should not be reduced.

The Committee recommended that the Health Effects Biology program element be funded at the level $50,644,000 which is the same level as the President's original January request and is $4,097,000 above the President's revised request. The Committee felt about this program as they did about the Human Health Effects program element. The program is aimed at understanding health effects on humans but uses animals or other relatively inexpensive biological test systems to study the effects of energy-related pollutants. Thus, information gathered in these animal and biological studies is used to predict human health effects and the Committee felt the work should be funded at the originally requested level. For example, research on the effects of ionizing radiation on the immune responses in biological systems, and on radiation chemistry aspects of radiobiological damage should be continued and not eliminated.

The Environmental Studies program element is recommended for funding at a level of $32,268,000 which is a reduction of $97,000 below the President's revised request and a reduction of $4,000,000 below the President's original budget submission. Thus, the Committee agreed with the President's budget revision in recommending a significant cut in this program. The basis for the Committee's recommendation was its discovery that there has been a great deal of apparent duplication within this element and that many of the projects seem to carry over from the old Atomic Energy Commission programs. For example, these seems to be redundant work involved in studying the transport and cycling of radionuclides in the environment.

The Committee recommended that the Physical and Technical Studies program element be funded at a level of $32,615,000, an increase of some $1,910,000 above the President's budget request and a reduction of $1,000,000 below his original submission. In this program, there are projects which gather samples of emissions from energy sources in order, first, to characterize these emissions and, second, to use the characterized samples to dose animals in order to study possible health effects. The Committee felt that this clearly-targeted program should not be reduced as much as the President had recommended.

The Committee recommended that the CO_2 and Climate program element be funded at a level of $10,000,000 which is $3,734,000 below the level in the President's revised budget request and $3,900,000 below the original budget request submitted by the President. The Committee was initially concerned at seeing that the 1981 request represented an increase of $4,950,000 (or 55 percent) over the 1980 level of $8,950,000. Upon investigation, the Committee found that a large fraction of the 1981 request was for study of geochemical carbon cycles and that another fraction of the request was for study of the socioeconomic impacts of climate change. In recommending the $10,000,000 funding level, the Committee intends that all of the elements of the climate program be restrained in their growth and that, in particular, the socioeconomic studies not be launched on a major basis until the analytical techniques for carrying out such studies are more developed. Similarly, the carbon geochemistry work should be conducted at a lower level than now contemplated in the program. The Committee acknowledges the importance of both these areas of study to the Department of Energy but believes that there is a need to move carefully in these areas. Finally, the Committee is aware of the excellent cooperation that continues to exist between this program in the Department of Energy and the National Climate Program. The Committee commends the Department for this cooperative effort which is an example to other government agencies.

The Health Effects Risk Analysis program element is recommended for funding at $2,600,000 which is $1,600,000 below the President's revised request and $2,000,000 below his initial request. The Committee recommendation represents a growth of $1,158,000 or 80 percent above the 1980 level in this program. The Committee believes that there is insufficient justification presented for the size of the increase requested in the original program and also that there is not an adequate explanation for the difference between this program and apparently similar activities funded under the Overview and Assessment program. Therefore, the Committee intends to examine this program element very critically in next year's budget and will be interested particularly in the difference between activities carried on here and in other parts of the program.

Life Sciences Research which appears in Section 118(C) of the bill is composed of two program elements entitled General Life Sciences and Nuclear Medicine Applications. The total recommended for this program is $42,650,000 which is $3,000,000 below the President's request of $45,650,000. The President did not change this request in his budget revision.

The General Life Sciences program element is recommended to be funded at $21,650,000 which is $4,000,000 below the President's request of $25,650,000 which was not revised. The Committee felt that much of this work is remote from the Department's mission and that some of it is again continuation of work that was begun under the Atomic Energy Commission and is now inappropriate. Although the Committee continues to feel as it did last year that the Department must have a strong foundation of basic research for its applied research activities, nevertheless, some of the work supported here seemed to be far removed from the Department's mission.

Nuclear Medicine Applications is recommended to be funded at a level of $21,000,000 which is $1,000,000 above the President's unrevised request. This is the only program element in the budget for which an increase is recommended. The increase is recommended to encourage the development of nuclear medicine techniques for application to environmental problems. The Medical Department of the Brookhaven National Laboratory has developed new methods for detecting and quantifying changes in the performance parameters of small regions of the lung. These new nuclear medicine research techniques are now ready for further development. Thus purpose of the increase is to fund this development and similar work in applying these techniques to persons having environmentally induced disease.

The category entitled "Program Direction," which appears in Section 118(D) of the bill, provides funding for the salaries and benefits of the staff of Office of the Environment. The Committee (and also the President in his budget revision) recommended that the full level of the original presidential request be maintained, that is, $11,133,000. The Committee is concerned that much of the program is already conducted by contracts which are so large and numerous that the small headquarters staff is barely able to supervise them. Therefore, the Committee approved the full request and urges that the Assistant Secretary make optimum use of the salary funds and positions available to her.

The Capital Equipment funding for the Environmental Programs is contained in Section 119(N) of the bill. The Committee approved the entire request of $16,640,000 for this item. The Committee continues to feel that the Environment Program is heavy on paper studies and contractor efforts and the Committee wanted to encourage the continued excellence of the laboratory programs. Therefore, the Capital Equipment request was approved in full. In other words, the Committee intends to equip the DOE to do the work themselves insofar as possible.

Similar reasoning applies to the request for construction funds which were approved in full at the requested level of $6,400,000. These funds appear in Section 120(F) and represent a series of relatively small projects for additions or modifications to existing laboratories. The Committee intends to facilitate the actual conduct of environmental programs by making adequate equipment and facilities available.

In last year's report, the Committee noted the importance of the Department's research into the health effects of low-level ionizing radiation and the need to produce scientifically and publicly credible results. The Committee recommended that scientific peer review by independent experts be used for evaluation of contract proposals, ongoing research and results. The Department assured the Committee that such review was being used. The Committee report said specifically "insofar as the review procedures represent a change from earlier practices, the Committee endorses them; if they do not represent a change, the Committee believes that much more must be done to avoid the charges of mismanagement that have plagued the Department in the past. The Committee firmly endorses the formal adoption by the Department of procedures for conducting rigorous review of this research and for acting on the results of these reviews." The Committee went on to express its concern that sufficient qualified personnel may not have been assigned to managing such research. This is brought up here because of the recent release of a "Review of Department of Energy Research on Human Health Effects of Low Doses of Ionizing Radiation," by the Committee on DOE Research on Health Effects of Ionizing Radiation, of the Assembly of Life Sciences of the National Academy of Sciences. That report cited some positive elements in DOE research program but also said "the [NAS] Committee found DOE's research program on human health effects of ionizing radiation to be uneven and in some respects unimpressive." They went on to say "the major gap in program organiaztion and management is the absence of a broadly based expert group of scientists and management consultants to provide continuous guidance with respect to the delineation of program content, planning, and direction." From the budget actions taken by the Committee, (explained in paragraphs above) it should be obvious that the Committee continues to support the Department's health effects research programs in spite of this strong report from the Academy of Sciences. Nevertheless, the Committee intends hereby to put the Department on notice that it is very concerned over this matter. The Academy report made two principal recommendations; "first, the [NAS] Committee recommends the development of a uniform scientific peer review process . . . second, and equally important, the [NAS] Committee recommends the development of a review and advisory process to provide continuing guidance and counsel to the [DOE] staff." This Committee intends to monitor closely the Department's response to the NAS recommendations. It is totally within the capability of the Department to respond fully to those recommendations if they so desire, and they are hereby strongly encouraged to do so.

The Committee is aware of a controversy that has arisen over the injection of radioactively contaminated water into an aquifer at the Idaho National Engineering Laboratory. While there does not seem to be a public health threat at this time, it does appear that this injection may be contaminating an otherwise clean aquifer. Also there seems to be some disagreement with Idaho officials on this matter. The Committee hopes that the Office of Environment will ensure that there is no unnecessary contamination of water supplies, and that the views of the State of Idaho and of the local citizens are considered and appropriately honored.

K. Supporting Research

SUMMARY OF COMMITTEE ACTIONS

The Committee decreased Basic Energy Sciences operating expenses by $10.7 million. The reductions in the subprograms are as follows:

	Millions
Nuclear science	$1.0
Materials sciences	2.6
Chemical sciences	3.1
Engineering, mathematical and geosciences	2.5
Advanced Energy Projects	0.9
Biological Energy Research	0.6

The Committee decreased Basic Energy Sciences capital equipment by $1.0 million. The Committee decreased the authorization by $6.3 million for Project 80-ES-10, Chemical and Materials Sciences Laboratory, Lawrence Berkeley Laboratory.

The Committee decreased Technical Assessment Projects by $3.5 million as follows: Assessment Projects by $0.5 million and Advanced Technology Projects by $3.0 million.

The Committee decreased University Research Support by $6.5 million as follows: University Institutional Agreements by $5.4 million, the University/Laboratory Cooperative Program by $0.6 million, and University Reactor Fuel Assistance by $0.5 million.

The Committee authorized a new line item, the Engineering Traineeship Program, with operating expenses of $5.0 million for FY 1981.

The Committee left Technical Programs and Policy Analysis unchanged.

1. BASIC ENERGY SCIENCES

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Nuclear science	30, 700	33, 400		−1, 000	32, 400
Materials sciences	79, 000	92, 000	−1, 600	−2, 600	89, 400
Chemical sciences	55, 100	63, 300	−2, 100	−3, 100	60, 200
Engineering, mathematical and geosciences	20, 100	28, 600	−2, 000	−2, 500	26, 100
Advanced energy projects	5, 000	8, 000	−800	−900	7, 100
Biological energy research	6, 000	8, 800	−500	−600	8, 200
Subtotal, operating expenses	195, 900	234, 100	−7, 000	−10, 700	223, 400
Program direction	2, 156	2, 444			2, 440
Subtotal	198, 056	236, 544	−7, 000	−10, 700	225, 844
Capital equipment:					
Nuclear science	1, 300	1, 400	−100	−100	1, 300
Materials sciences	6, 300	7, 600	−300	−300	7, 300
Chemical sciences	3, 700	4, 740	−300	−300	4, 440
Engineering, mathematical and geosciences	1, 250	2, 060	−300	−300	1, 760
Advanced energy projects	200	300			300
Biological energy research	300	400			400
Subtotal, capital equipment	13, 050	16, 500	−1, 000	−1, 000	15, 500
Construction:					
Authorization		6, 800		−6, 300	500
Budget authority	17, 950	6, 800		−6, 300	500
Total	229, 056	259, 844	−8, 000	−18, 000	241, 844

[1] Indicates changes to original FY 1981 B/A request.

Basic Energy Sciences is the major Department of Energy program which supports and administers basic research in the physical and biological sciences, engineering and mathematics in order to provide fundamental information leading to improvements in existing technologies and to discover new concepts, materials, processes and techniques important for the production and efficient use of energy. BES assembles, encourages and supports a body of the Nation's most competent researchers in physics, chemistry, biology, the materials and nuclear sciences, engineering, geosciences and mathematics, in order to expand the base of scientific knowledge pertinent to energy and energy-related topics. In addition, the program will continue to support construction and operation of pioneering and/or unique facilities for use by scientists throughout the Nation. Direct commercialization of results from basic research occurs fairly often; however, more often the benefits accrue as the accumulated knowledge and understanding of detailed processes and properties become an integral part of the body of data on which applied technologies rest. Construction funds for the completion of the Chemical and Materials Sciences Laboratory at Lawrence Berkeley Laboratory at Berkeley, California were included in the FY 1981 budget request.

The Basic Energy Sciences program includes six subprograms: Nuclear Science; Materials Sciences; Chemical Sciences; Engineering, Mathematical and Geosciences; Advanced Energy Projects; and Biological Energy Research.

(a) NUCLEAR SCIENCE

Nuclear Science is comprised of two separate but related activities. The first, low energy nuclear science, supports research into the low energy nuclear properties and reactions of nuclei and fundamental chemical and physical properties of the actinide elements. This activity also provides for the measurement of nuclear data important to the development of fission and fusion energy technologies and nuclear waste management and for the compilation and critical evaluation of this data. The second, isotope preparations, funds the production, separation and purification of a wide variety of stable isotopes and rare heavy isotopes for scientific research and for medical and industrial applications.

The low energy nuclear science activity includes support for a comprehensive study of delayed neutron emission from fission products using the TRISTAN on-line isotope separator at the Brookhaven High Flux Beam Reactor. This is a coordinated effort engaging scientists from laboratories and universities. The effort to upgrade DOE-supported university low energy accelerator facilities will continue. In addition, research will continue on improving our understanding of the chemical properties of actinides under various environmental conditions. An entirely new data base describing the chemistry of the actinides is required for the solution of important problems in nuclear waste management and isolation.

The isotope preparations activity provides samples of unique research materials for sale and loan to a broad research community. A sizeable world market exists for separated stable isotopes and rare heavy isotopes for use in a variety of research programs as well as medical and industrial applications. Through support of major facilities at the Oak Ridge National Laboratory, the Isotope Preparation activity funds the production, separation and purification of a wide variety of such materials, not available commercially, which are sold and loaned both domestically and internationally.

(b) MATERIALS SCIENCES

Every energy technology, especially the more advanced technologies, has materials problems that critically affect its economic, scale up, or technical feasibility. Without a proper background of knowledge about materials properties and structures, unnecessarily broad, expensive, and time consuming efforts are required to achieve solutions to these problems. The materials sciences subprogram provides the scientific base upon which more focused developmental efforts are constructed.

Materials Sciences provides for basic research in the fields of metallurgy, ceramics, solid state physics and materials chemistry directed toward developing our understanding of the fundamental properties of materials—their origins and the compositional and structural factors which influence these properties. This increased understanding provides a scientific basis upon which to 1) structure applied programs to solve materials problems faced by developing energy production, conservation and conversion technologies; 2) anticipates materials problems in developing technologies; 3) provide new materials for technologies of the future; and 4) provide a basis for analysis of unanticipated energy materials problems that develop as advanced technologies evolve.

Approximately 80% of the research is conducted in the DOE laboratories; the remainder is primarily carried out by universities, although about 1% is done in industrial and not-for-profit laboratories. Major programs are located at the Oak Ridge National Laboratory, site of the High Flux Isotope Reactor and a 1 MeV Electron microscope; the Argonne National Laboratory, site of the Intense Pulsed Neutron Source (under construction) and a 1.2 MeV Electron Microscope; the Brookhaven National Laboratory, site of the High Flux Beam Reactor and the National Synchrotron Light Source (under construction); the Lawrence Berkeley Laboratory, site of the 1.5 MeV Electron Microscope and the Atomic Resolution Microscope (both being established).

This budget provides for an increase in the percentage of funds going into the university sector. Further, it will permit special DOE laboratory facilities (electron microscopes, neutron sources, and the soon-to-be completed National Synchrotron Light Source) to be more readily available to the scientific community as a whole. Construction of the IPNS will be completed and initial operation for research will commence. The violet ultraviolet ring of the National Synchrotron Light Source will be placed in operation with attendant initial operating costs. Research on materials problems related to nuclear waste isolation will be expanded as will research on corrosion (related to coal conversion) with the build-up of a major new corrosion center at the University of Minnesota. Research on ceramics and high temperature materials (related to fossil fuel technologies and conservation) will be strengthened, as will research on solar related problems and the mechanical properties of materials (fracture, strength, and creep).

(c) CHEMICAL SCIENCES

Chemical Sciences provides for basic research in chemistry, chemical engineering and atomic (i.e., non-nuclear) physics aimed at understanding reactions and processes essential to the development, conservation and utilization of energy sources. Major aspects of the program deal with the fundamentals of solar energy conversion, fossil fuels, combustion, fusion, and long-term research leading to new concepts. Work is carried out in DOE laboratories, universities, and to a smaller extent at industrial and non-profit organizations. The research in Chemical Sciences is administered in two major areas, Fundamental Interactions and Processes and Techniques.

The Fundamental Interactions activity supports research dealing with the most basic physical and chemical characteristics of matter at the level of molecules, atoms, ions and electrons. The forces between such particles determine whether they will chemically react with each other, whether energy will be liberated or absorbed during such interaction, and whether any other phenomena will occur which can lead to successful conversion, storage and conservation of energy.

Initial operation of the Combustion Research Facility at Sandia-Livermore will begin in FY 1981. In-house researchers and outside users from universities, national laboratories and industry will use the Facility's advanced lasers and other diagnostic equipment on scientific problems related to fundamental combustion kinetics, to engine research and to coal combustion. Other efforts in this activity are important for our understanding of solar photochemistry including photosynthesis and for helping the advance of nuclear fusion, magnetohydrodynamics and other energy processes.

The Process and Techniques activity supports research aimed at understanding the basic processes by which chemical reactions take place. The increasing complexity of energy processes and techniques, such as the chemistry of fossil conversion, of nuclear waste processing and of processes ancillary to fusion systems, requires added insight in order to make them more efficient and to reduce their environmental impact. For example, our understanding of molecule-surface interactions has led to a new concept for regenerating sulfur-poisoned nickel catalysts, thus paving the way for more economical and energy-conserving processing of fuels by catalysis, including petroleum refining and the upgrading of coal derived liquids. Areas that will be emphasized in FY 1981 include fossil-related organic chemistry, combustion-related fluid dynamics, fission product separation chemistry and solar-related chemistry of biomass conversion.

The FY 1981 request for Chemical Sciences also includes funds for the completion of the Chemical and Materials Sciences Laboratory at Lawrence Berkeley Laboratory. This project, when completed, will provide for about 50,000 square feet of laboratory space to an existing building for chemical and materials sciences research. In addition these funds will provide for the purchase, installation and housing of an atomic resolution microscope and its ancillary equipment.

(d) ENGINEERING, MATHEMATICAL AND GEOSCIENCES

The engineering, mathematical and geosciences subprogram supports researchers in the disciplines of mechanical, structural, electrical and systems engineering, mathematics, statistics, computer sciences, geology, geochemistry and geophysics. These disciplines are essential for virtually every energy technology being developed or envisioned in the future. This subprogram consists of the following three activities: Engineering Research; Applied Mathematical Sciences; and Geosciences.

The Engineering Research activity was initiated in FY 1979 to explore new ideas and, initially, advance the general understanding of energy transfer processes, advanced industrial technology and process dynamics and control. Emphasis and high priority are accorded to research topics filling gaps in fundamental data and understanding essential for long-range advances in energy processes and systems. High priority topics include studies on friction and lubrication and lubrication, fluid flow through porous materials, heat transfer, process control, engineering aspects of combustion and resource recovery. These research efforts will enhance our ability to raise energy system efficiencies, to open new technology opportunities, to improve reliability and to extend the life of energy systems. For example innovations in a new type of process control strategy may lead to pilot plants with sophisticated feedback control systems and thus improve coal liquefaction and other chemical processing.

The Applied Mathematical Sciences activity is the DOE-wide focal point for advancing the state-of-the-art in mathematical, statistical and computer science. This activity will support research yielding improved computational methods for current and future generations of computers. These methods are the basic building blocks for large scale computational models utilized to improve the efficiency and safety of energy systems by simulating, for example, fluid flows in hypothetical reactor accidents, enhanced oil recovery processes, automobile engines, and atmospheric pollutant transport processes. Recently this activity has developed and implemented the first reliable method for solving equations of magnetohydrodynamics in three dimensions. These equations are fundamental to the description of magnetic fusion devices such as tokamaks, mirror machines and others. The availability of this new method is already impacting the future course of the magnetic fusion process.

The Geosciences activity focuses on the development of an adequate information base and an increasing understanding of the earth's crust and earth processes in research areas relevant to energy resources and their utilization and to the disposition and isolation of wastes. The need for this effort is implicit in the fact that all energy resources are found in the earth and the sun, and that all waste products are returned to the earth and its atmosphere. This activity will remain the base program in geology, geophysics and geochemistry, continue areas of special interest in geochemical migration, continental scientific drilling and rock mechanics, and start two important new initiatives, one in ocean margin drilling studies and the other on the identification and characterization of mineral hosts for element isolation. The former initiative bears on the evaluation of the hydrocarbon potential of the outer continental margins and is being planned in close coordination with the broader scientific studies of the ocean margin funded through the National Science Foundation. The latter initiative evaluates different minerals and rocks for their ability to contain radioactive wastes over long periods of time.

(e) ADVANCED ENERGY PROJECTS

The Advanced Energy Projects subprogram supports exploratory research on novel technical concepts related to energy. The objective is to establish for each such concept a proof of scientific feasibility and an indication of economic viability. Also supported are projects which, because of their interdisciplinary nature—or for some other reason—do not fit well into any of the existing technical programs. Typically, the projects supported fall into the "high risk, high potential payoff" category.

The goal of this subprogram is to support about twenty new concepts annually. Each project selected is supported for a limited time only, typically not to exceed three years. After such a period, the concept is expected to either prove itself to a point where a source of further support can be identified, or else be dropped. Projects are considered on the basis of proposals submitted by researchers from universities, industry and national laboratories. Proposals from all sources are treated on an equal basis: all are subjected to a detailed technical peer review by individually selected panels of experts. Although this subprogram is only two years old, significant accomplishments have already been made. For example, this subprogram funded the laboratory-scale verification and preliminary economic evaluation of a new method for extracting oil from tar sands which is now being field-tested under another program combining Federal and private funds totaling several million dollars.

(f) BIOLOGICAL ENERGY RESEARCH

The Biological Energy Research subprogram is the only area in the Federal government funding research specifically aimed at providing fundamental information using biological systems in energy matters. Biological Energy Research emphasizes botanical and microbiological research to develop a broad, intensive understanding of the biological factors involved with plant biomass productivity, of techniques which use microorganisms to convert biomass and other organic materials into fuel and chemicals and of methods to use biological systems for sparing energy resources. This subprogram will build a base of fundamental knowledge in an area which until recently has been virtually ignored.

Research will be carried out to gain a better understanding of how plants function in producing biomass. In addition, studies will involve research designed to comprehend fundamental microbiological conversions of biomass and other organic materials into fuels and chemicals. This research effort may increase energy alternatives in the future either by increasing plant productivity or by converting substances to useful fuels or chemicals. For example, a possible biochemical indicator of drought resistance in plants has been identified. Such an indicator would be very useful in screening plant varieties for biomass production on marginal lands where water availability is a problem. In addition, research in this activity has recently isolated bacteria and algae from natural sources, which can synthesize quantities of hydrocarbons resembling petroleum. These findings also suggest that the bioconversion of various forms of biomass into petroleum-like products is a possibility in the coming years.

COMMITTEE ACTION

Basic Energy Sciences—$18.0 million decrease

The Committee reduced operating expenses by $10.7 million for Basic Energy Sciences. This action still allows for 14 percent growth over FY 1980 for these programs. The reductions in the subprograms are as follows:

	Millions
Nuclear science	$1.0
Materials sciences	2.6
Chemical sciences	3.1
Engineering, mathematical and geosciences	2.5
Advanced energy projects	0.9
Biological energy research	0.6

The Committee reduced capital equipment by $1.0 million. The Committee directed that this reduction not affect equipment for new basic energy sciences facilities, such as the National Synchrotron Light Source at Brookhaven National Laboratory, the Intense Pulsed Neutron Source at Argonne National Laboratory, and the Combustion Research Facility at Sandia Laboratories-Livermore.

The Committee reduced authorization for Project 80–ES–10, Chemical and Materials Sciences Laboratory, Lawrence Berkeley Laboratory (LBL), by $6.3 million. The Committee recommended a delay of one year in construction of the proposed laboratory-office addition to the Lawrence Berkeley Laboratory-Chemical and Materials Sciences Laboratory.

2. TECHNICAL ASSESSMENT PROJECTS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
Assessment projects	2,500	3,200		−500	2,700
Satellite power systems	5,000	5,500	−5,500		5,500
Advanced technology projects	5,000	12,000		−3,000	9,000
Subtotal, operating expenses					17,200
Program direction	466	540			540
Subtotal	12,966	21,240	−5,500	−3,500	17,720
Capital equipment: Satellite power systems	500	0			0
Total	13,466	21,240	−5,500	−3,500	17,740

[1] Indicates changes to original FY 1981 B/A request.

Technical Assessment Projects provides the Department with independent, objective analyses and assessments of research and technical needs and opportunities, including conceptual development and evaluation of the Satellite Power System. In addition, this program supports advanced technology projects designed to develop engineering and economic data on innovative, potentially high payoff ideas which do not fit readily into existing Department of Energy programs. These assessments and projects are carried out under the auspices of the Director of Energy Research in order to fulfill his mandated responsibility to advise the Secretary on the Department's R&D programs. The program encompasses three separate activities: Assessment Projects; Satellite Power Systems; and Advanced Technology Projects.

The Assessment Projects subprogram is aimed at providing DOE with the capability for independent, objective analysis of the Department's technical needs and opportunities. Its objectives include providing for rigorous assessment of existing or proposed technological initiatives, and examining the base of research that underlies a broad range of energy technologies, such as heat transfer and materials. The subprogram is carried out through studies, workshops, panels, and other mechanisms which allow the Department to make use of the best scientific and technical talent. Emphasis will be placed on the expansion of the technology base activities to minimize potential failures or cost overruns in the Department's high-cost pilot and demonstration activities. Incorrect assessment of technical risks or inadequate R&D support have led to problems with these large facilities after they are well under construction.

The Satellite Power Systems (SPS) subprogram is currently working in FY 1980 on the completion of the Concept Development and

Evaluation Program (CDEP). This three year study, which was undertaken in conjunction with NASA, was intended to provide an initial assessment of the SPS concept and to provide a basis for making more informed decisions about SPS work. The SPS concept is designed to capture solar energy with satellites in a geostationary orbit (a point in space about 22,000 miles above the Earth, which maintains a fixed position relative to Earth) and converting it, in space, to electrical energy by means of solar cells. In turn, this energy would be converted to radio frequency (RF) energy and sent to Earth in a focused beam aimed at a ground receiving antenna (rectenna) where it would be reconverted to electricity for distribution in a utility grid.

The CDEP has already identified a number of serious concerns about which it may be necessary to develop additional information, beyond the scope of the initial three year program, before any firm recommendation to proceed with an SPS Ground Based Exploratory Development (GBED) program could be supported. In FY 1981 this activity will continue to study further the microwave bio-effects, the non-microwave bio-effects, the microwave communication effects and the atmospheric effects of SPS. In addition, further systems definition will be undertaken, along with the development of an implementation plan for the GBED program if the decision is to move forward with such a program.

The objective of the Advanced Technology Projects (ATP) subprogram is to develop engineering and economic data on innovative concepts which have potentially high payoffs but which do not readily fit into existing DOE programs. This program also serves as a mechanism for accelerating the transition of ideas which have been shown to be feasible from an engineering standpoint to the appropriate project organization within DOE for further development. Such projects might not be funded originally by an energy technology program for several reasons. For example, the potential high-payoff of these projects is usually accompanied by high risk, which makes them relatively unattractive funding choices for mainline program organizations. In addition, projects of this type typically fall outside of the main mission of most R&D organizations, and are therefore frequently not able to compete because available funds are all required for the pursuit of major ongoing programs. Further, this program also provides a source of funding for meritorious proposals that cut across several energy technology programs.

COMMITTEE ACTION

Technical Assessment Projects—$3.5 million decrease

The Committee reduced operating expenses by $3.5 million as follows:

> Reduced Assessment Projects by $0.5 million. This reduction maintains the assessment projects activity at the FY 1980 level while the program is re-evaluated to match the changing responsibilities of the Director of the Office of Energy Research.
>
> Reduced Advanced Technology Projects by $3.0 million. The reduction provides a more modest increase for this program over the FY 1980 funding level. The Committee recommended deferring new projects in FY 1981, while continuing as many previously initiated projects as possible.

3. UNIVERSITY RESEARCH SUPPORT

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses:					
University institutional agreements	2,300	7,700	−3,000	−5,400	2,300
University/laboratory cooperative program	2,800	3,800		−600	3,200
University reactor fuel assistance	1,700	2,500		−500	2,000
Subtotal, operating expenses	6,800	14,000	−3,000	−6,500	7,500
Program direction	267	320			320
Total	7,067	14,320	−3,000	−6,500	7,820

[1] Indicates changes to original FY 1981 B/A request.

The University Research Support Program provides an organization and funding focus for certain university-based research and education programs which both deal with longer-range energy research problems and which cut across the missions of the various research and technology offices in the Department. The Program consists of three interrelated activities.

University Institutional Agreements Program.—This program activity provides support for campus-wide exploratory research programs at a small number of leading university research centers. The objectives on selected longer-term energy problems is to conduct "proof of concept" research involving university faculty and students. Projects which subsequently show promise are then submitted for review and follow-on funding to the appropriate Departmental program office and to private industry. In addition, support is provided through this program activity to developing and strengthening the energy research and education capabilities of smaller, historically minority institutions and to efforts directed at encouraging more minority students to pursue energy-related scientific and technical careers. The Department's fiscal year 1981 plans are to support ten campus-wide research programs (including five continuations of existing awards) and fifteen minority research awards. Research apprenticeship assignments in individual DOE Laboratories and facilities will also be supported for up to 500 minority students during the summer of 1981. The original FY 1981 budget request also included funds to initiate a new goal-oriented, multidisciplinary research programs involving teams of university faculty and students from different academic disciplines working together on a specific major energy R&D problem. Up to three such awards were to be made in 1981 at the level requested.

University Reactor Fuel Assistance Program.—The objective of this program activity is to fabricate fuel for a small number of specialized university nuclear research reactors and to support the use of these reactors on a "shared" basis by scientists from other, smaller universities and colleges without such reactors. Funds are requested to refuel five research reactors in 1981 and to support a small number of reactor sharing efforts. In addition, support is requested for the development and fabrication of Lower Enriched Uranium (LEU) for use in university reactors. This is in compliance with Department of State regulations regarding the non-proliferations of nuclear materials.

University/Laboratory Cooperative Program.—This activity encompasses a wide variety of research participation and special training projects involving university faculty and students in twelve DOE National Laboratories and contractor organizations. The program is designed to increase the interactions and flow of scientific and technical information between university and National Laboratory scientists and to upgrade the knowledge of university scientists about current developments in energy R&D. Funds are requested in FY 1981 to increase the numbers of faculty and students participating in such programs to over 2,000 with special emphasis on participation of faculty from smaller colleges.

COMMITTEE ACTION

University Research Support—$6.5 million decrease

The Committee reduced operating expenses by $6.5 million, as follows:

> Reduced University Institutional Agreements by $5.4 million. The reduction would delay all new initiatives proposed for FY 1981, while continuing existing programs at the FY 1980 funding level.
>
> Reduced University/Laboratory Cooperative Program by $0.6 million. The reduction would reduce the number of contractor sites that have been scheduled for increases in operating levels in FY 1981.
>
> Reduced University Reactor Fuel Assistance by $0.5 million. The reduction would delay establishment of the proposed low enrichment fuel fabrication activity.

4. ENGINEERING TRAINEESHIP PROGRAM

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses (total)	0	0	0	+5,000	5,000

[1] Indicates changes to original fiscal year 1981 budget authority request.

COMMITTEE ACTION

Engineering Traineeship Program—$5.0 million increase

The engineering traineeships established by this Act are to be offered in energy-related engineering fields where there are critical manpower needs.

The program will consist of traineeships in the amount of approximately $10,000 each. A $7,500 stipend for the academic year would be made available to the recipient, and the amount necessary to cover the cost of administration and tuition, which would average approximately $2,500, would go to the institution.

A separate line item is added to make clear that the Committee intends that the program will be administered by the Office of Energy Research.

Any public or private educational institution that can meet the guidelines established by DOE may apply for these traineeships and distribute them to qualified students. The Committee intends that there should be no hindrance to universities that need to augment the stipend through other funds, including those from private sources. Summer research stipends are particularly encouraged.

While some schools may require or at least strongly recommend teaching experience before granting the Ph.D., the emphasis should be on completing the academic program as quickly as possible. To that end, combining this traineeship with a teaching assistantship is discouraged.

Finally, the Committee intends that these fellowships will be granted by schools with existing Ph.D. programs and will be restricted to American citizens. They will not be used in any way to launch new Ph.D. programs.

The Committee also intends that the Director of the DOE Office of Energy Research assess the mid- to long-range needs for scientific and technical manpower in energy-related fields. This activity is to be coordinated with similar efforts recently initiated in the National Science Foundation and the Department of Education, and is to be carried out primarily in-house.

5. TECHNICAL PROGRAM AND POLICY ANALYSIS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
Operating expenses: Program direction (total)	1,935	1,981			1,981

[1] Indicates changes to original FY 1981 B/A request.

The goal of the Technical Program and Policy Analysis (TPPA) activity is to provide the personnel resources required by the Director of Energy Research in order to carry out his responsibilities under the Department of Energy Organization Act (P.L. 95-91), or as mandated by the Secretary, in areas beyond the scope of the assigned Energy Research programs. Among the responsibilities assigned to the Director of Energy Research in the DOE Organization Act are: (1) monitoring the Department's research and development programs in order to advise the Secretary with regard to any undesirable gaps or duplications; (2) advising the Secretary with respect to the well-being and management of the Multipurpose Laboratories; (3) supervising or supporting research activities carried out by any of the Assistant Secretaries. Additional responsibilities assigned to the Director by the Secretary since formation of the Department include: (1) providing independent advice to the Secretary and Under Secretary on budgeting priorities for energy research and development programs; (2) providing support for the Energy Research Advisory Board, the Research and Development Coordination Council, and the Field and Laboratory Coordination Council; (3) preparation of R&D strategies for the development of specific energy technologies; (4) chairing the R&D Strategy Committee of the International Energy Agency; (5) providing policy and technical analyses relative to nuclear non-proliferation issues.

During the past year, the personnel funded under TPPA carried out the second Technology Base Review, which assessed the basic and applied research, and exploratory development efforts throughout the Department. Strategies were prepared for the development of fission, fusion, solar, and geothermal energy, in connection with the FY 1981 Internal Review. Other accomplishments include coordination of the development of institutional plans for the Multipurpose Laboratories, lead mission assignments, and development of a system for authorizing the assignment of new work to them. Short-range evaluations of laboratory performance were also conducted. The Office of Energy Research also assisted in establishing a DOE Nuclear

Non-Proliferation Policy Committee to provide high-level Departmental attention to nuclear non-proliferation issues, and carried out a number of analyses, both policy-oriented and technical in nature, of subjects related to non-proliferation.

The budget request will provide salaries, benefits and related personnel expenses for 43 full-time permanent positions.

COMMITTEE ACTION

Technical Program and Policy Analysis—no change

L. General Science and Research

1. HIGH ENERGY PHYSICS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Physics research	71, 850	76, 500			76, 500
Facility operations	105, 100	114, 300		−2, 000	112, 300
High energy physics technology	42, 050	50, 580		−2, 000	48, 580
Subtotal, operating expenses	219, 000	241, 380		−4, 000	237, 380
Program direction	589	865			865
Subtotal	219, 589	242, 245		−4, 000	238, 245
Capital equipment: Facility operations	36, 000	39, 000		−2, 000	37, 000
Construction:					
Authorization		266, 600		−144, 000	122, 600
Budget authority	69, 500	77, 600	−4, 000	−4, 000	73, 600
Total:					
Authorization		547, 845		−150, 000	397, 845
Budget authority	325, 089	358, 845	−4, 000	−10, 000	348, 845

[1] Indicates changes to original FY 1981 B/A request.

High Energy Physics research has its goal the exploration and understanding of the properties of matter and energy in their most basic forms. The High Energy Physics program is currently in a period of great achievement in which a multitude of experimental observations and theoretical ideas are being molded into a comprehensive picture of the fundamental nature of matter and energy. For example, neutrino beam experiments performed at very high energies at Fermi National Accelerator Laboratory (Fermilab) in Illinois, and at Brookhaven National Laboratory (BNL) in New York, and electron beam experiments performed at Stanford Linear Accelerator Center (SLAC) in California, provided strong experimental evidence to support the unification of two of the four fundamental forces of nature, the electromagnetic force and the weak force, (the other two are the strong force and the gravitational force) into a single unified theoretical framework. The theoretical work relating to this unification of forces was recognized by the awarding of the 1979 Nobel Prize in Physics to three physicists, including two U.S. High Energy Physics theoretical physicists.

SUMMARY OF COMMITTEE ACTIONS

The Committee decreased operating expenses by $4.0 million as follows: Facility Operations by $2.0 million and High Energy Physics Technology by $2.0 million.

The Committee decreased capital equipment by $2.0 million.

The Committee decreased construction authorization by a total of $144.0 million. The Committee decreased authorization by $27.0 million for Project 81–E–218, Tevatron, Phase 1, Fermi National Accelerator Laboratory. The Committee decreased authorization by $131.5 million for Project 78–10–b, Intersecting Storage Accelerator (ISABELLE), Brookhaven National Laboratory.

(a) PHYSICS RESEARCH

The Physics Research category supports the direct costs to the experimental research groups for planning, design, and execution of experiments, and for the analysis, interpretation, and publication of the results of the data. It also supports the full costs for theoretical physics research. Experiments in this field require the use of sophisticated detection apparatus to record the collisions of intense, high energy particle beams which are available only at the high energy accelerator centers. Most of the research (about 75%) is done by university-based physicists. Because of the size and complexity of a typical high energy physics experiment, users from a number of institutions frequently work together in collaboration. They first conceive and plan the experiments at their home institutions. Then a formal proposal for carrying out the experiment is prepared and submitted to the appropriate laboratory for review by a Program Advisory Committee and by laboratory management. If the experiment is accepted for scheduling, the experimenters assemble the apparatus they have agreed to provide and go to the laboratory where the experiment is installed and performed, usually with significant assistance from laboratory staff. The recorded data is generally taken back to the home institutions for analysis and the preparation of the results for dissemination at scientific meetings and in scientific journals.

(b) Facility Operations

Facility Operations supports the accelerator and experimental facility operating crews, the electric power, and the materials and services required to support the operation of the accelerators, colliding beam facilities, beam lines, and large multipurpose detection and analysis systems.

High energy physicists study the basic structure of matter and the fundamental forces in nature by using intense beams of elementary particles to bombard targets. The beams are produced in high energy particle accelerator and colliding beam facilities. The large capital investment and complexity of the facilities require that they be few in number, operated in national facilities and open to all qualified users. With the closing of the Zero Gradient Synchrotron (ZGS) at Argonne National Laboratory (ANL), the Department of Energy high energy physics accelerator facilities to be operated in FY 1981 are located at three centers which provide: (1) the accelerators and colliding beam devices which are the sources of energetic electrons, positrons, and protons; (2) the beam transport and target systems to provide particles of the required type to the experiments; (3) the large multipurpose detection systems to observe the collisions; and (4) the data analysis and large central computer systems for data analysis.

New facilities are a critical component of the program. Progress in a forefront field such as high energy physics requires the provision of new facilities with new experimental capabilities on a timely basis, often requiring incorporation of the latest technological advances. The new high energy facilities are being phased in sequentially. First there is the SLAC/LBL Positron-Electron Project (PEP) which provides electron-positron colliding beams with energies up to 15 GeV x 15 GeV at peak lumuninosity at SLAC (A GeV or giga electron volt is equal to one billion electron volts). Experiments using PEP are scheduled to begin in mid-FY 1980.

The three high energy accelerator and colliding beam facilities to be operated under DOE support in FY 1981 are the Alternating Gradient Synchrotron (AGS) at Brookhaven National Laboratory (BNL), the proton synchrotron at Fermi National Accelerator Laboratory (Fermilab), and the electron linear accelerator and SPEAR and PEP electron-positron colliding beam facilities at Stanford Linear Accelerator Center (SLAC). Each of these DOE accelerator centers provides a unique set of capabilities complementary to the other, and is a vital element of a comprehensive national research program. These facilities are operated as national facilities and are available for use by scientists at the operating laboratories, universities, and for collaboration with scientists from other countries.

The ISABELLE project at BNL, initiated in FY 1978, is a 400 GeV x 400 GeV proton-proton colliding beam facility using the existing AGS as an injector. The project consists of two rings of superconducting magnets in which protons injected from the AGS at 30 GeV will be accelerated to energies as high as 400 GeV. The beams will intersect at six points, four of which will be surrounded by research halls. The project also provides the required supporting systems such as the refrigeration, injection, vacuum, RF and control system for the ring magnets as well as the ring housing, support buildings and utilities.

The Energy Saver project at Fermilab will consist of a ring of rapid cycling superconducting magnets located within the existing Fermilab accelerator tunnel. Its goals are to permit: 1) operation at 500 GeV for extraction and use in the experimental program in the external beam areas; 2) operation at about 800 GeV with a slow cycle for internal target experiments; and 3) a substantial reduction in electric power use and cost through the use of the energy saving superconducting technology. The use of superconducting magnets will result in operation of the accelerator at 500 GeV using only about 20 percent as much electric power as the present 400 GeV accelerator operation. In addition, the high magnetic field capability of the superconducting magnet will make possible the subsequent extension of the accelerator energy up to 1000 GeV.

The FY 1981 request for construction funding includes $2,000,000 to initiate the Tevatron-Phase I project at Fermilab. This project will provide for: 1) the addition of more refrigeration and radiofrequency accelerating structure to the Energy Saver superconducting accelerator ring so it can be used as a 1000 GeV x 1000 GeV proton-antiproton colliding beam storage ring; 2) the construction of an antiproton source and accumulation system; and 3) the construction of two experimental areas suitable for detectors to study the very high energy proton-antiproton collisions. The goal is to produce relatively intense counter-rotating beams of protons and antiprotons which when brought into collision would have 2000 GeV of available reaction energy. The energy achieved would be the highest available in the world.

(c) HIGH ENERGY PHYSICS TECHNOLOGY

The physics research effort and the technology effort which supports it are two distinct but highly interdependent parts of the High Energy Physics program. The research generates a need for new technical capabilities, which challenge the technology. The responding advances in technology make possible new research capabilities which permit the forefront experiments that extend our physics knowledge; the understanding of these new results often suggests new areas of follow-up experimentation which lead to a further challenge to develop new technical capabilities. The new concepts, techniques and devices which result are then used to enhance the efficiency, effectiveness and capability of existing accelerator and experimental facilities and also to support the design and construction of new facilities when further improvements of existing ones are no longer sufficient to meet the research needs.

High Energy Physics Technology can be divided into two major areas: accelerator research and development (R&D) and experimental facility R&D. Both aspects are essential for continued progress and vitality of the field and for ensuring that the maximum research capability can be achieved per dollar spent.

COMMITTEE ACTION

High Energy Physics—$150 million decrease

The Committee decreased operating expenses for High Energy Physics by a total of $4.0 million. Facility Operations was decreased by $2.0 million and High Energy Physics Technology was decreased by $2.0 million. The latter reduction is to be directed to avoid impact on important near-term accelerator and experimental facility research and development.

The Committee decreased capital equipment by $2.0 million. This reduction would defer acquisition in FY 1981 of equipment not considered to be of high priority.

The Committee decreased the authorization for construction by $144 million as follows:

(*a*) reduced authorization for Project 81–E–218, Tevatron, Phase 1, Fermi National Accelerator Laboratory, by $12.5 million. DOE requested a fiscal year 1981 authorization of $39.5 million, which would fully authorize this project. The recommended partial authorization of $27.0 million will meet all project obligations through fiscal year 1982. (The recommended budget authority for fiscal year 1981 was left unchanged at $2.0 million.)

(*b*) reduced authorization for Project 78–10–b, Intersecting Storage Accelerator (ISABELLE), Brookhaven National Laboratory, by $131.5 million (recommended reduction of $4.0 million in budget authority). DOE requested a fiscal year 1981 authorization of $196.5 million, which would fully authorize this $275 million project through its scheduled completion in fiscal year 1986. The recommended partial authorization of $65 million will meet all obligations through fiscal year 1981 while allowing the Committee to periodically review progress during the remaining years of construction. (The recommended budget authority for fiscal year 1981 is $41.0 million in accordance with the Administration's revised budget request)

2. NUCLEAR PHYSICS

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request [1]	Committee action: Changes to original authorization request	Committee action: Total authorization
Operating expenses:					
Medium energy nuclear physics	41,700	45,555			45,555
Heavy ion nuclear physics	33,600	35,975			35,975
Nuclear theory	6,100	7,000			7,000
Subtotal, operating expenses	81,400	88,530			88,530
Program direction	174	270			270
Subtotal	81,574	88,800			88,800
Capital equipment (total)	8,200	9,400			9,400
Construction:					
Authorization		35,300		−21,600	13,700
Budget authority	14,800	17,300	−4,000	−6,500	10,800
Total:					
Authorization		133,500		−21,600	111,900
Budget authority	104,574	115,500	−4,000	−6,500	109,000

[1] Indicates changes to original FY 1981 B/A request.

The Department of Energy's Nuclear Physics program is the major Federal research effort concerned with advanced experimental and theoretical studies of the interactions, structure, and other fundamental characteristics of nuclei. Its three major components are: Medium Energy Nuclear Physics, Heavy Ion Nuclear Physics, and Nuclear Theory. Medium Energy and Heavy Ion Nuclear Physics are each experimental efforts heavily dependent upon the existence and effective operation of major accelerator facilities. Of these, five are operated as national facilities whose beam time is made available to the Nation's scientists on the basis of scientific merit and technical feasibility of proposals submitted. The national facilities are: the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos Scientific Laboratory; the William H. Bates Linear Accelerator at Massachusetts Institute of Technology, the SuperHILAC at Lawrence Berkeley Laboratory; the Bevalac at Lawrence Berkeley Laboratory; and the double MP tandem van de Graaff facility at Brookhaven National Laboratory. The new Holifield Heavy Ion Research Facility at Oak Ridge National Laboratory will also be operated as a national facility later in 1980. Each of the national facilities (as well as, to a lesser extent, smaller accelerators at Argonne National Laboratory, Oak Ridge National Laboratory, the University of Washington, Yale University, and Lawrence Berkeley Laboratory) accommodates major university-based user research programs. A typical user group plans experiments at the home institution, executes and partially analyzes experiments at the national facility, and completes analyses and publication of results at the home institution. The Nuclear Physics program is the major Federal supporter of such university-based user groups in the field of nuclear research. The Nuclear Theory effort is closely related to the experimental work in that it provides guidance to experiments along those lines most likely to yield a deeper and more unified understanding of nuclear phenomena, and it helps to interpret experimental results in terms of fundamental theory. Support of work under Nuclear Theory is almost equally divided between national laboratory-based theorists and university-based theorists.

The objectives of the Nuclear Physics program are to carry out long range basic research into interactions and structure of nuclei (theory and experiment); to operate accelerator facilities for the nationwide research community; to provide accelerator facilities with state-of-art instrumentation to maintain frontier reesearch capability; and to identify and transfer practical applications of basic nuclear research where it seems appropriate.

SUMMARY OF COMMITTEE ACTIONS

In the Nuclear Physics Program, the Committee reduced construction authorization by a total of $21.6 million.

The Committee decreased authorization by $6.5 million for Project 81-E-233, Argonne Tandem-linac Accelerator System (ATLAS), Argonne National Laboratory. The Committee decreased authorization by $15.1 million for Project 80-GS-5, National Superconducting Cyclotron Laboratory, Michigan State University.

(a) MEDIUM ENERGY NUCLEAR PHYSICS

The principal objective of Medium Energy Nuclear Physics is to carry out experimental research aimed at improving our understanding of the atomic nucleus and of the interaction of nuclear and subnuclear particles with atomic nuclei. In addition, the research studies shed light on the nuclear forces and symmetry laws which determine nuclear properties and interactions. The medium energy domain is defined by the energy of projectiles available from the accelerators which are used for probing atomic nuclei. Medium energy begins at that energy at which a subnuclear particle, the pion, is first produced in a nuclear reaction. On an energy scale used in science, this value is about 200 MeV. (An MeV is one million electron volts.) The pion has much to do with our understanding of nuclear forces, so this is a logical starting point. The upper limit of the medium energy domain includes research and accelerator operation at those facilities where the primary particle beam energy is less than 10,000 MeV (or 10 GeV). However, Medium Energy Nuclear Physics also includes research at higher energy facilities if the scientific interest lies in the properties and interactions of nuclei rather than particle physics. This activity supports all accelerator operations costs of the Clinton P. Anderson Meson Physics Facility (LAMPF) at Los Alamos Scientific Laboratory (a high intensity, high duty factor, 800 MeV proton linear accelerator) and the William H. Bates Linear Accelerator at Massachusetts Institute of Technology (a high duty factor, high beam quality, 400 MeV electron linear accelerator).

(b) HEAVY ION NUCLEAR PHYSICS

Heavy Ion Nuclear Physics is a frontier area in the study of the atomic nucleus. The Department of Energy provides most of the support for this kind of research in the United States. The program studies the atomic nucleus through the use of probes of heavy ions, which are projectiles of nuclei heavier than the helium nucleus, which has a mass of 4 atomic mass units. The use of these massive (on the nuclear scale) and complex projectiles creates new conditions for the study of nuclear phenomena. During the collisions, uniquely high values of energy concentration, rotational velocity, and compression exist which enable the research scientists to gain a better understanding of the nucleus. Beams of heavy ions are produced by accelerator facilities, the major ones being the SuperHILAC and Bevalac at LBL and the Holifield Heavy Ion Research Facility ot ORNL.

The Argonne Tandem/Linac Accelerator System (ATLAS) (TEC=$6,900,000: $4,000,00 in FY 1981 and $2,900,000 in FY 1982) will provide the capability for production of heavy ion beams with energies ranging from about 27 MeV/amu (atomic mass units) for light nuclei such as carbon to about 5 MeV/amu for nuclei as massive as silver. In this energy range, the projectile energies are comparable to nuclear binding energies. Thus ATLAS-based research will emphasize investigations of the structure of nuclei near the limits of destruction. ATLAS work will complement the high energy Bevalac studies of nuclear matter at extremes of excitation and lower energy studies of properties of individual nuclear energy levels. The excellent time structure of ATLAS beams will make time-of-flight techniques a high precision tool for study of the products of heavy ion nuclear reactions. ATLAS will also have the capability, not available at other heavy ion accelerators, for rapid and precise variation of the energy of its beams. This latter property is especially important for investigations of the mechanisms by which heavy nuclei transfer mass and energy during a collision and for studies of the mechanisms by which heavy ion projectiles fuse with target nuclei and then fission apart.

The National Superconducting Cyclotron Laboratory at Michigan State University will enter the construction phase in FY 1981. The beam energies from this facility will be approximately ten times higher than ATLAS, making this facility ideally suited for exploring new aspects of nuclear behavior that are most likely to occur at these higher energies where the projectile begins to compress significantly the nuclear matter of the target. When completed, beams from this facility will help to fill the large energy gap which exists at present between the Bevalac and the Holified Heavy-Ion Research Facility. For FY 1981, $8,900,000 has been requested for construction of the buildings which will house the accelerator and associated experimental areas. Activity would also include detailed engineering of accelerator components.

(c) NUCLEAR THEORY

One of the important goals of physics is to develop physical theories which can describe a system in a comprehensive way and predict results which are in accord with experimental measurements. The characterization of properties of objects such as mass, charge and angular momentum and the identification of the forces of nature such as gravitational, electromagnetic and nuclear allow the theorists to describe physical systems with use of mathematical formalisms. In physics, physical theories are tested as to the extent of their applicability and as to their degree of accuracy. As newer and better theories are developed, the older ones turn out to be special approximations and often continue to be useful.

COMMITTEE ACTION

Nuclear Physics—$21.6 million decrease

The Committee decreased the authorization for construction in the Heavy Ion Nuclear Physics subprogram by $21.6 million as follows:

(a) Recommended a delay of one year for the start of actual construction on Project 81–E–233, Argonne Tandem-linac Accelerator System (ATLAS), Argonne National Laboratory. The reresult is a decrease in authorization of $6.5 million and a corresponding decrease in budget authority for FY 1981 of $3.6 million. This action closely follows the Administration's revised FY 1981 budget request. However, the Committee decided that it would be advantageous to authorize ATLAS in FY 1981 at a level of $400,000. This small authorization and appropriation will save about six months in the project schedule compared to complete deferral until FY 1982.

The $400,000 would be used for architect-engineering work and long-lead procurement as follows: $150,000 for the design of the required building addition; and $250,000 for the procurement of high quality niobium for the superconducting linear accelerator component.

(b) reduced authorization for Project 80–GS–5, National Superconducting Cyclotron Laboratory, Michigan State University (MSU), by $15.1 million. The Committee recommended a corresponding decrease in FY 1981 budget authority of $2.9 million.

DOE requested a fiscal year 1981 authorization of $24 million, which would fully authorize this $30 million project through its scheduled completion in fiscal year 1984. The Committee understands that the MSU Superconducting Cyclotron is the highest priority construction project in the U.S. Nuclear Physics Program for which the DOE and the National Science Foundation (NSF) both provide funding. Currently, the MSU construction project is under the management of DOE, but it is not yet clear whether DOE or NSF will manage facility operations upon completion of construction. The Committee is concerned about this ambiguous relationship and the lack of NSF participation during the construction phase. Consequently, the Committee recommended slowing construction during fiscal year 1981 pending receipt by Congress of a DOE/NSF memorandum of understanding concerning contractual and management arrangements for the MSU facility.

M. Construction of Facilities

1. GENERAL

The Department of Energy Civilian Research and Development programs include construction projects. For Fiscal Year 1981, the construction projects account for approximately 17 percent of the entire R&D budget.

Each project entails not only a commitment to build a facility, but also a commitment to operate and maintain that facility over an appreciable period of time.

The Committee on Science and Technology is vitally interested in seeing that these projects are designed and constructed in accordance with the highest standards, on schedule and within the original total estimated cost.

The Committee also recognizes that the success of certain construction projects, particularly those involving the demonstration of a technology, can influence future trends in energy supply.

(a) SUMMARY OF CONSTRUCTION PROJECTS BY SUBCOMMITTEE

This section provides information about the projects authorized in fiscal year 1981 for planning, design, construction and modification of facilities for use in research, development and demonstration.

Table 1 lists the total amounts authorized by Subcommittee and the subtotals for each program area within the Subcommittee for plant and capital projects.

Statements of Committee Actions and Committee Views which pertain to construction projects follow table 1.

A list of major and minor construction projects, including the total estimated cost, the amounts previously authorized, the amounts requested by the Department of Energy, the amounts authorized by the Committee, the variance from the budget request, and the total amounts authorized through fiscal year 1981, is provided.

TABLE 1—PLANT AND CAPITAL (CONSTRUCTION PROJECTS)

[Totals by subcommittee]

	Dollars in Thousands
Energy Research and Production	682, 932
Energy Development and Applications	419, 750
Natural Resources and Environment	6, 400
Departmental Projects	67, 800
	1, 176, 882

2. COMMITTEE ACTIONS AND VIEWS

(*a*) The Committee adopted three provisions which pertain to construction projects. The first provision, which appears in Sec. 124 of H.R. 6627 is intended to provide a consistent basis of accountability for construction, development and demonstration. Specifically, the Committee does not want funds to be transferred, at will, by the DOE, between operations and plant and capital accounts.

While providing for such accountability, Section 124 provides increased flexibility in the funding of construction projects and divides construction projects into three categories: Major Construction ($5,000,000 or more total estimated cost to the Federal Government); Minor Construction (between $1,000,000 and $5,000,000); and General Plant projects (less than $1,000,000). Major Construction projects which exceed their original total estimated federal cost may acquire up to 10 percent additional funds from other Major Construction projects upon notice to the appropriate committees. Funds may be shifted among Minor Construction projects and new projects may be started during the fiscal year so long as the $5,000,000 ceiling is not exceeded for a particular project. An annual report describing all changes in the Minor Construction project list is required by this section; the DOE is also expected to keep the Science and Technology Committee of the House of Representatives (House Science) and the Energy and Natural Resources Committee of the Senate (Senate Energy) up to date on all Minor Construction revisions as part of its responsibility to keep the Congress "fully and currently informed." The only limit on shifting of General Plant Project construction funds is the $1,000,000 maximum per project. In addition, a special provision provides a method for the Secretary or Under Secretary to start construction of a major project between annual budget submissions, but only, in those rare instances when it is in the national interest to do so.

A definition of construction projects is included in the bill language. Under the definition, all portions of the design and construction of a facility or of the modification of a facility are to be included as one construction project. Furthermore, construction projects are to be grouped for budget and accounting purposes only as provided in this section. Categories involving modifications to a variety of facilities such as Modifications to Reactors and Accelerator Improvements shall no longer be used as this work will fall in the Major, Minor, or General Plant categories.

The only exceptions to the general rule that all construction activity must be funded from a discrete construction account follow.

1. Those construction projects with a total estimated cost under $500,000 may be funded from either operating expenses or as a General Plant project.

2. Conservation demonstration projects, involving either new construction or projects involving modification, addition or retrofit of existing plant equipment, where the total federal estimated cost of such projects do not exceed $5,000,000, such projects may be funded from either operating expenses or as plant and capital expenses. The House Science and Senate Energy Committees are to be kept fully and currently informed of all such conservation projects with a total estimated federal cost in excess of $1,000,000.

3. The conceptual design of a project may be funded from operating expenses, from Planning and Design, or in one of the other categories as part of the specific project being designed.

4. The fabrication of discrete pieces of equipment for testing or evaluation within test facilities is not considered to be an element of construction activity. Examples of these operating funds components include pumps, valves, steam generators, neutral beam injectors, magnets, solar collectors, accelerator targets, and prototype accelerator components.

5. For the purpose of expediting the initiation of certain research projects, experimental tests may be funded either from operating expenses or plant and capital. These experimental tests include magnetic fusion test devices costing less than $15,000,000; coal process demonstration units with input up to 9 tons per day; prototype wind machines with design capacity up to 100 kilowatts electric; MHD heat and seed recovery experiments; high level waste related heating experiments; geological investigations, and laboratory scale experiments. Some of these projects, such as magnetic fusion devices, process development units, and high level subsurface radioactive waste test facilities, may involve considerable construction activity and the Committee may elect to transfer those projects from operating expenses to plant and capital. The House Science and Senate Energy Committees are to be kept fully and currently informed on experimental tests with a total estimated federal cost of $1 million or more.

6. Solar heating and cooling demonstrations under the Solar Heating and Cooling Demonstration Act of 1974 may be funded from operating expenses. The House Science and Senate Energy Committees are to be provided information, equivalent in detail to that provided by the Department under the Minor Construction category, when the construction contract is awarded as well as annually, through completion of the project.

Item (4) of Section 124, Planning and Design, is intended to give the Department of Energy flexibility in determining the feasibility of certan projects and to encourage the Department to proceed with a significant level of design work prior to budgeting projects for construction. Planning and Design authorizations are for the purpose of enabling the DOE to obtain better data and therefore have a stronger basis for selecting only those projects for construction which hold the best promise of successfully contributing to this Nation's energy supply. Planning and Design is also intended to enable the DOE to prepare realistic cost estimates, to develop detailed designs and project management plans, and consequently to avoid cost overruns on construction projects.

Section 124 is meant to be the governing law with regard to the handling of facilities during FY '81. Unless serious problems arise in the implementation of the section, it will be used in future years as well. Since the FY '82 budget submissions to Congress will occur during FY '81, the Committee expects the submission to be made in accordance with the requirements of this section.

(*b*) The second provision is contained in Section 125. This provision is intended to establish, within DOE Headquarters, a Research and Development Construction and Facilities Office for two purposes:

First, to establish a uniform policy under which all construction related to research, development and demonstration programs can be performed. The policy would include such items as standardized specifications, uniform reporting and accountability, standard performance measurement criteria for construction management, improved cost estimating methods, and uniform contracting practices for design and construction.

This organization would not be responsible for individual project management, which the Committee believes should continue to be performed on site. The organization would, however, review and maintain cognizance over all planning, design and construction activities and would offer consulting services to all energy program activities. The centralized construction organization would also review all annual plant and capital budgets for "construction practice sufficiency" and accuracy of cost estimates. It would not, however, pass judgment on the programmatic need for such facilities. Likewise, the central construction activity would not have final authority over program construction projects, which would remain with the appropriate program managers.

The second purpose for establishing a Research and Development Construction and Facilities Office is to provide the overall coordination of planning, utilization, maintenance, modification, repair, expansion, and construction of institutional facilities at all Department of Energy centers, including the National Laboratories, Energy Technology Centers and other such locations. In the case of such institutional facilities, as used for civilian energy research and development purposes, the central organization would have the authority to evaluate the facilities needs of such centers consistent with the Department's civilian research and development objectives in order to prevent the initiation of unnecessary work," to determine the adequacy of cost estimates, to approve annual budgets and to assure that all property is properly maintained insofar as possible within the funds appropriated for such purposes.

The most important aspect of Section 125 is to assure that the Research and Development Construction and Facilities Office be managed by and staffed with personnel, excluding secretarial and administrative support personnel, having college education's in the engineering disciplines as well as considerable "hands on" design and or construction field experience. The very purpose of this activity is to have knowledgeable construction people working on construction projects. This is not an activity for retraining personnel from other disciplines or lines of work.

(*c*) The third provision concerns the design and construction of laboratory/office buildings. The Committee deliberated at length over the high cost estimates associated with many of these projects and acted to have the Department of Energy appoint a panel of engineers and architects to carefully review the construction costs in order to minimize them. The Committee looks forward to having the Department manage such projects closely so that no unnecessary features are incorporated in those buildings under consideration or planned for the future. Specifically, the Committee is concerned about the design, methods of contracting, extent of specifications, and schedules of the following projects:

81–T–311: HEDL Support Services Building (total estimated cost undetermined) (Richland).

80–ES–10: Chemical and Materials Sciences Laboratory, $6,300,000 (Lawrence Berkeley Laboratories).

81–E–308: Energy Systems Research Laboratory, $20,000,000 (Oak Ridge, Tenn.).

81–E–311: Energy Science and Technology Building expansion, $12,000,000 (Brookhaven).

81–E–312: Environmental and energy technology facility $18,00,000 (Richland Wash.)

81–H–08: Energy Technology Building, Sandia (Total estimated cost undetermined) Albuquerque.

79–1–9: SERI—(Total estimated cost undetermined) Golden Colo.

80–FE–3: Program Support Facility, Pittsburgh Energy Research Center, $9,500,000.

78–3–0: Mirror Fusion Test Facility (Total estimated cost unknown) Lawrence Livermore Laboratories.

The Committee has added a provision that the above facilities could include solar and conservation features provided that such features are cost effective over a 25 year life including a real rate of return of 7 per centum per year.

(*d*) *Geothermal Energy*

(1) The Committee acted to reduce, by $2 million, the budget request for Project 80–G–1, Geothermal Demonstration Power Plant, Valles Caldera, N.M.; $8,911,000 was authorized instead of the $10,911,000 requested by the Department. This reduction was not believed to have any detrimental effect on the project.

(2) The FY 1981 authorization for Project 80–G–2, Second 50 MWe Demonstration Plant, site to be determined, was increased by $10,000,000, demonstrating the Committee's continuing support for this facility.

(*e*) *Civilian Waste Management*

(1) In civilian waste management, the Committee deleted Project 81–T–302, Salt Test Facility, for lack of adequate justification. The project as proposed by the Department is an insignificant extension of the results obtained in Kansas in the late 1960s in Project Salt Vault and can better be done in laboratories or in cooperation with tests in a German mine. The facilities added were Project 81–H–01, Technology-Demonstration Repository, authorized at $6,000,000; Project 81–H–02, Technology-Demonstration Repository, authorized at $2,000,000; and Project 81–H–03, High-Level Waste Solidification Demonstration Facility, authorized at $1,000,000.

The Committee specified that the repositories are to be for wastes, rather than spent fuel, and are to be based upon the use of engineered barriers for an initial period, thereby enabling the use of already explored locations and present technology. The Committee believes there are no technical or economic reasons for not proceeding with these projects in the interest of the safe disposal of nuclear waste. No sites were specified for the three facilities, but the Department is to determine the sites before the end of the first quarter of FY 1981. The shaft for at least one of the two Technology-Demonstration Repositories should be started during FY 1981. Additional drillings for further site characterization may be done concurrently.

The Committee requires that the High Level Waste Solidification Facility produce vitrified wastes by FY 1985 for use in the Technology-Demonstration Repositories.

Further discussion of the Committee's intention with respect to these facilities appears in the civilian waste management section of this Report.

(*f*) *Nuclear Energy*

(1) Project 81-T-310, General Plant Projects for Breeder Reactor Programs, was reduced by $3,500,000 in accordance with budgetary constraints. The Department is asked to select specific projects for deferral on the basis of their relative priority.

(2) Ten million dollars was added to Project 78-6-f. Fuels and Materials Examination Facility, Richland, Washington. This amount was added specifically to increase the scope of the automated fuel fabrication line and it therefore represents an increase in the Total Estimated Cost of the project by an equal amount.

The Committee believes that an automated fuel fabrication line is essential to worker safety and enhanced materials accountability. Since there will not be any commercial facilities of this type in operation, it is even more critical that the Department proceed expeditiously toward full automation.

(3) Project 81-T-311, Support Services Building, HEDL, Washington, was added by the Committee and authorized at a level of $1,000,000 for FY 1981 for Title I preliminary engineering studies and commencement of Title II design. While there is no total estimated cost for this project, the Committee intended that this project be among those to be reviewed by the panel of architects and engineers discussed previously.

(4) The Fiscal Year 1981 authorization for Project 81-T-312, General Plant Project, Test Reactor Area, Radioactive and Non-Radioactive Liquid Waste Systems, Phase II, INEL, Idaho, was authorized at $800,000 to provide for an alternative system which will eliminate the need for direct discharge of tritium into deep injection wells.

(5) Project 78-6-e, Liquid Metal Engineering Center Modifications (ETEC), Santa Susanna, California, was authorized at a level of $7,400,000 in fiscal year 1981 to provide for engineering and construction of a pump test loop of the capacity needed to test a 1000 MWe breeder reactor primary pump.

(6) Project 81-H-04, Barnwell Nuclear Fuel Plant, Barnwell, South Carolina was added by the Committee. $2,500,000 was author-

ized for the purpose of enabling the Secretary of the Department of Energy to enter into negotiations with the owners of this facility for the purpose of acquiring it by sale, lease or condemnation.

As part of the negotiation, the Department is to review all "as-built" or construction drawings, all operating and maintenance manuals and all existing guarantees and warranties on equipment. The Department is to consider the extent of the work that would be required to complete the construction of the facility. The Department is also to evaluate the provisions for maintaining the plant with emphasis on remote maintenance requirements.

(*g*) *Fusion Energy*

(1) In fusion energy, the authorization for Project 80–MF–3, Elmo Bumpy Toros, site undetermined, was increased by $7,100,000 in order to authorize the project for a full two years and to illustrate the Committee's support for the project.

(2) Project 81–MF–2, Impurity Studies Experiment Modification (ISX–C), Oak Ridge, Tenn. In addition to the FY 1981 authorization of $5,500,000, the Committee transferred $4,500,000 to this project from operating expenses. The ISX has in the committee's view reached the point in development where a greater level of effort is justified and consequently greater funding support for the construction of additional facilities is required.

(3) The FY 1981 authorization for Project 81–T–313, General Plant Projects, Princeton Plasma Physics Laboratory and Oak Ridge, Tenn. was reduced by $1,000,000 in keeping with current budgetary constraints; a total of $4,400,000 was authorized for the project in FY 1981. The Committee believes the decision concerning which projects are to be deferred should be made by the Department.

(4) Project 78–3–a, Mirror Fusion Test Facility, Lawrence Livermore Laboratories, was authorized in the amount of $6,000,000 to rescope the tandem mirror project to MFTF–B. Based on the success of the tandem mirror experiment (TMX), the Committee supports changing the scope of that project and authorizes DOE to proceed with design and purchase of materials for the second magnet. The Committee expects, however, that testing of the first magnet will proceed as planned and that the results of such testing will be available before the second magnet is constructed. This is to assure that any corrective action or design changes that may be needed are made before constructing the second magnet.

(5) The Department requested $45,000,000 for fiscal year 1981 for Project 76–5–a Tokamak Fusion Test Reactor, Princeton, N.J. The Committee authorized $40,000,000 with the expectation that the project can be successfully completed within half of the currently estimated contingencies of $10 million. The Committee fully supports the project and looks forward to its successful completion and operation. It was partly because of the outstanding work accomplished with the PDX that the Committee believed it was time to begin engineering effort on the Fusion Engineering Test Facility.

(6) The FY 1981 authorization for Project 78–3–b, Fusion Materials Irradiation Test Facility (FMIT), Richland, Washington, was reduced by $22,250,000 in accordance with current budget constraints.

The amount authorized, $57,600,000, provides for two years of appropriation consistent with current funding schedules.

(7) The Committee acted to initiate a new Plant and Capital Project 81–MF–1, Fusion Engineering Test Facility (FETF). The Committee's action is intended to provide funding for Title I, Preliminary Engineering and investigation of potential sites in FY 1981 leading to the selection of the most suitable location for this facility considering available resources, future requirements, and need for early facility opration.

The FETF will provide the engineering "know-how" to design future fusion reactors. The FETF will combine the engineering principles with plasma physics behavior characteristics in order to provide guidance for the entire magnetic fusion program in the future. The ultimate objective of the entire program is to eventually build a demonstration plant consistent with national energy objectives.

The FETF will consist of a reactor, in all probability equipped with heat removal systems. It may or may not produce electricity and it may or may not produce synthetic fuels. The Fusion Advisory Panel will assist in establishing the objectives of this facility.

The final design and construction of FETF will be based on the experience and knowledge gained from the Takomak Fusion Test Reactor in Princeton, New Jersey.

The Committee authorized $4,000,000 to initiate this project in FY 1981.

The Committee requests that the Department submit a report to the House Committee on Science and Technology and the Senate Committee on Energy and Natural Resources at least 90 calendar days before completing Title II Final Design and/or before commencing construction. The purpose of this report is to present to the Committees, the full plans, the basis of reactor parameters, the design objectives, alternate configurations, cost estimates, site location analysis, and similar appropriate information. This report will form the basis of the Committees' deliberations in subsequent authorizations of actual construction or long-lead procurement (with the exception of materials for superconducting magnets).

(8) Project 81–MF–3, Fusion Research Center, MIT, Boston, Mass. was added by the Committee at an authorized level of $200,000 to provide for laboratory and office renovations to accommodate fusion program operations.

(h) *Basic Energy Sciences*

(1) The Committee deferred authorization for the second part of Project 80–ES–10, Chemical & Materials Science Laboratory, Lawrence Berkeley Laboratories, California. It was recognized that this $6,300,000 deferral will delay the commencement of the laboratory office addition to this laboratory. While not authorizing the addition in FY 1981, the Committee expects this proposed project to be among those to be reviewed by the panel of architects and engineers discussed previously.

(i) *General Purpose Facilities*

(1) Project 81–E–309, Rehabilitation of General Purpose Physical Plant, Argonne National Laboratories was authorized at a level of

$10,100,000, which is $5,000,000 less than the FY 1981 budget request. The Committee is in sympathy with the need for this work but has limited the authorization to an amount which provides adequate authorization for the first two years of effort.

(2) Project 81-E-310, Transmission and Distribution Systems Upgrading, Richland Washington, was authorized at $6,050,000 to provide for the proposed work associated with the electrical transmission system. The proposed work on supervisory systems will be reviewed by the Committee to obtain a better understanding of the need and costs associated with such a system prior to subsequent authorizations for the work.

(3) The Environmental and Energy Technology Facility, Richland Washington, Project 81-E-312, was authorized at a level of $4,000,000 for FY 1981. Along with many other similar facilities, however, the Committee intends that this project be included among those to be reviewed by the panel of architects and engineers previously discussed.

(4) Project 81-E-313, Central Energy Conservation Facility, Brookhaven National Laboratories, Upton, New York, was reduced by $2,000,000. The Committee is in complete agreement with the need for this work. The reduction was made only in authorization (and not in budget authority), consistent with budgetary constraints.

(5) A $1,000,000 reduction was made in Project 81-E-317, Roof Replacement, Idaho National Engineering Laboratories. The Committee has agreed to a total estimated cost of $4,300,000. Instead of the $5,300,000 requested in the FY 1981 budget. The project therefore has been fully authorized for the scope defined in the budget. Taking into account current roofing costs, the age of the facilities, the most likely need for flashing replacement, repairs to decking, new insulation of a lower conductivity ("U" Valve), replacement of gutters and downspouts, removal of existing roofing, and transportation of old materials to a landfill, the Committee's action reflects a belief that a funding level of $4,300,000 is more than adequate to carry out the proposed project.

(6) Project 81-E-320, Central Supply Facility, Argonne National Laboratories, was deferred pending further review of the need for this facility in light of more restrictive budgets and the choices that have to be made in order to continue with basic energy program development work.

(7) A new project, Project 81-H-08, Energy Technology Building Sandia Laboratories, Albuquerque was authorized for FY 1981 at a level of $1,000,000. The conditions at Sandia are such that work cannot continue efficiently. While authorizing commencement of this project in FY 1981, the Committee intends that it be included among those projects to be reviewed by the panel of architects and engineers discussed previously.

(j) *High Energy Physics*

(1) Project 81-E-218, Tevatron, Phase I, Fermi National Accelerator Laboratories, Batavia, Illinois was authorized at a level of $27,000,000, providing authorization for requested appropriations in Fiscal years 1981 and 1982. Of the funding requested in the FY 1981 budget, $12,500,000 was not authorized due to current budgetary constraints.

(2) Project 78–10–b, Intersecting Storage Accelerator (ISABELLE), Brookhaven, National Laboratories, Upton, New York was authorized at $65,000,000. This level of funding represents a decrease of $131.5 million from the fiscal year 1981 request of $196.5 million. The action was taken because of current budget constraints and in accordance with Department priorities.

(*k*) *Nuclear Physics*

(1) Six million five hundred thousand dollars was deferred from project 81–E–223, Argonne Tandem-Linac Accelerator System (ATLAS), Argonne National Laboratory. This action will delay the construction of this new facility. The fiscal year 1981 Authorization of $400,000 is intended to provide for architect-engineering work and long-lead procurement of high-quality niobium.

(2) Project 80–GS–5, National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, was authorized at a level of $8,900,000. This level of funding represents a decrease of $15,100,000 from the Administration's budget request due to budgetary constraints. This action may impact the progress of construction in Fiscal Year 1981.

(*l*) *Uranium Enrichment, Advanced Isotope Separation*

(1) Project 81–T–501, Isotopes Research and Development Laboratory, Los Alamos, New Mexico was authorized for one year at $1,500,000 rather than the requested $16,000,000 as a result of budgetary constraints. This action should not delay initiation of the project.

(2) One million eight hundred thousand dollars was authorized for Project 81–T–502, Advanced Isotope Separation Laboratory, Livermore, California. This action is expected to delay the start of construction until Fiscal Year 1982. The action was taken because of budget constraints.

(3) Project 78–5–C, Laser Isotope Separation Facility, Richland, Washington, was authorized at a level of $1,000,000 in order to fund Title I and Title II design work. This funding augments the $3,500,000 authorized in previous fiscal years for this project.

(*m*) *Uranium Enrichment Activities*

(1) Project 81–R–506, Environmental Protection and Safety Modifications, Phase I, Gaseous Diffusion Plants was authorized at a level $19,000,000 below the budget request. This reduction will not delay any work scheduled for fiscal year 1981. The Committee is aware of and agrees that environmental laws must be upheld. The protection of the environment will continue to be a high priority national objective.

The Committee does not see conflict between reasonable environmental protection measures and progressive energy supply development projects. The Committee is aware of and concerned about State environmental protection requirements associated with this project. The Committee believes these standards, which exceed comparable Federal regulations, to be unnecessarily stringent, and the Committee intends to review the project carefully before authorizing any additional funds in the future.

(2) Project 71–I–f, Process Equipment Modification, Gaseous Diffusion Plants, was deauthorized in the amount of $111,600,000 in order

to reduce the fiscal year 1981 budget authority by $20,000,000. This was a budget-cutting measure but was believed to be consistent with the schedule slippage at Portsmouth which resulted from a labor strike.

The project is expected to require additional authorization in fiscal year 1982.

(3) Project 76-8-g, Enriched Uranium Production Facilities, Portsmouth, Ohio was authorized at $116,325,000 instead of the $286,325,000 originally requested by the Department. This action was taken to support the Administration's amended budget request which was to delay the project one year by reducing the budget authority $170,000,000.

(*n*) *Fossil Energy*

(1) Project 81-T-404, General Plant Projects for Technology Centers, six locations. The Committee authorized $3,000,000, instead of DOE's requested $6,000,000, to remain within budget restraints.

(2) Project 81-T-405, Atmospheric Fluidized-Bed Combustion—Industrial Demonstration Projects. The committee authorized an additional sum of $10,000,000 to maintain the program originally authorized for initiation in FY 1980.

(3) Project 81-T-406, Coal-Oil Mixtures Demonstration Projects. The authorization of $7,000,000 is re-direction of funds from operating funds to construction in the program.

(4) Project 80-FE-3, Program Support Facility, Pittsburgh Energy Technology Center. The DOE request of $7,800,000 was reduced by the Committee to $2,200,000, providing funds required only for FY 1981.

(5) Project 81-T-402, Surplus Water Containment and Waste Water Treatment Facility. Since this facility is not needed until 1984, the committee deferred DOE's FY 1981 request of $1,300,000.

(6) Project 80-FE-10, Atmospheric Fluidized-Bed Combustion Component Test and Integration Unit. The DOE request was $9,935,000 to continue construction of the project. The Committee decided that this project duplicated other efforts, such as the TVA pilot plant, and that the projected cost overrun appeared to be excessive. Accordingly, the committee rejected the DOE request and also de-authorized $10,000,000. DOE should advise the committee on plans to dispose of the project building and to terminate the contract.

(7) Project 79-1-r, SRC-II (liquids) Demonstration Plant. The DOE request for $210,000,000 was judged by the Committee to exceed FY 1981 project requirement and the amount authorized was reduced to $160,000,000.

(8) Project 78-2-d, SRC-I (solids) Demonstration Plant. The Committee did not concur with DOE's FY 1981 budget request of $195,000,000 and authorized $150,000,000 as adequate to meet present schedule and anticipated rate of commitments.

(9) Project 77-1-b, Second High Btu Synthetic Pipeline Gas Demonstration Plant, Noble County, Ohio. The DOE schedule for decision on this program competition is imminent and the Committee anticipates that both the Illinois and Ohio projects will become contracts. It appears that regulatory application approvals will allow for some plant site-related activity in Ohio in FY 1981. The Committee there-

fore authorized $38,000,000 for a total of $48,000,000, to fund probable commitments.

(10) Project 76–1–b, High Btu Synthetic Pipeline Gas Demonstration Plant, Perry County, Illinois. The DOE FY 1981 budget request of $55,000,000 was reduced by the Committee to $5,000,000 as being sufficient, with previously-authorized $122,000,000, to fund anticipated activity through FY 1981.

(11) 80–FE–12, Peat-Fuel Combustion Demonstration Project. The Committee authorized $3,100,000 to enable DOE to begin design of a demonstration facility for evaluation and utilization of peat, due to its availability as an important regional resource.

(*o*) *Solar Technology*

(1) Project 81–T–306, Solar Industrial Cogeneration Project. The Committee deferred funding to the future, eliminating DOE's FY 1981 request for $1,900,000.

(2) Project 80–B–1, Biomass Thermochemical Gasification Experimental Facility. The Committee deferred DOE's FY 1981 request for $2,000,000 on the basis that process evaluation was not sufficiently advanced to make construction commitments in FY 1981.

(3) Project 79–1–a), Solar Energy Research Institute Facility. The DOE FY 1981 budget request of $10,000,000 was reduced by the Committee to $7,000,000.

The Committee believes that the Solar Energy Research Institute in Golden, Colorado must have adequate research and office facilities to carry out its important missions. The existing leased buildings do not provide sufficient laboratory facilities and will require additional modifications to accommodate the increasing solar program responsibilities of SERI.

Moreover, the Committee is concerned that the proposed ned permanent facility for SERI has been further delayed by the Administration's budget decisions and particularly by the recent request for a rescission in FY 80 funds and a deferral of $9M in the FY 1981 request of $10M. In particular, the lack of adequate funding for FY 1981 could jeopardize the State of Colorado's offer of 300 acres to SERI for the new complex unless certain minimum improvements are made to the land in order to demonstrate an intent on the part of the federal government to move forward with the permanent facility. Moreover, the construction of a test site infrastructure to allow SERI experiments to go forward is also threatened by the Administration's proposed $1M funding for FY 1981.

The Committee endorses the concept of incorporating solar and energy conservation features into the proposed permanent facility, however, it is concerned about the overall cost estimates which have been reported. The SERI permanent complex should provide adequate and necessary facilities to accommodate its operations at a reasonable cost taking into consideration its special needs and its energy saving features.

Therefore, the Committee's action in authorizing the $7 million for FY 1981 is to allow the establishment of test site infrastructure, minimal site preparation and utilities work, and any design work necessary to assure that the permanent facility is designed to address the cost concerns of this Committee. This Committee action should not be construed as an endorsement of the total estimated costs which have been reported to date.

(4) Project 81–H–04, First Advanced Medium Scale Wind Turbine (MOD–6). The Committee transferred $1,000,000 from project operating expense for this vertical axic configuration.

(5) Project 81–H–05, Second Advanced Medium Scale Wind Turbine (MOD–6). The Committee transferred $1,000,000 from project operating expense for this vertical axis configuration.

(6) Project 81–H–06, First Advanced Multimegawatt Wind Turbine (MOD–5). The Committee transferred $2,500,000 from project operating expense, anticipating construction of a system having electric power output in excess of 1 MW.

(7) Project 81–H–07, Second Advanced Multimegawatt Wind Turbine (MOD–5). The Committee transferred $2,500,000 from project operating expense, anticipating construction of an alternate system having electric power output in excess of 1 MW.

(8) Project 81–H–10, Six Additional Advanced Multimegawatt Wind Turbines (MOD–5). The Committee added this project and authorized $5,000,000 for additional demonstration projects to meet Wind Act goals and to promote competitive, cost-shared technology. It is anticipated that at least two different designs will emanate from this project.

(*p*) *Departmental*

Project 80–DA–6, Alternate Energy Source, Pantex Plant, Amarillo, Texas, was reduced by $31,000,000 leaving a fiscal year 1981 authorization of $12,300,000. The reduction in authorization was made because of budgetary constraints, but is not expected to delay or otherwise adversely affect the project.

3. ENERGY RESEARCH AND PRODUCTION

The Subcommittee has jurisdiction over the research, development, and demonstration of geothermal energy, civilian waste management, nuclear energy, and fusion energy construction projects. The Subcommittee also has jurisdiction over projects in the areas of supporting research, high energy physics, nuclear physics, and uranium enrichment. For fiscal year 1981, this Subcommittee has jurisdiction over general purpose facilities and shares jurisdiction over Departmental projects.

The total amounts authorized for construction work (plant and capital) for Fiscal year 1981 was:

	Thousands
Geothermal	**$18, 911**
Civilian Waste Management	**14, 576**
Nuclear Energy	**82, 200**
Fusion Energy	**170, 700**
Basic Energy Sciences	**500**
General Purpose Facilities	**85, 950**
High Energy Physics	**122, 600**
Nuclear Physics	**13, 700**
Advanced Isotope Separation	**7, 270**
Uranium Enrichment Activities	**166, 525**
Total	**682, 932**

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATION, SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION

[In thousands of dollars]

Project No. and description	Total estimated cost	Previous authority	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fisca-year 1981
GEOTHERMAL ENERGY							
80-G-1—Geothermal Demonstration Power Plant Project, Valles Caldera, N. Mex	127, 216	39, 429	10, 911	NC	−2, 000	8, 911	48, 340
80-G-2—Second 50 MWe Demonstration Power Plant, site to be determined	(1)	8, 000	0	0	+10, 000	10, 000	18, 000
Total construction, geothormal energy					+8, 000	18, 911	
CIVILIAN WASTE MANAGEMENT							
81-T-301—General Plant Projects Richland, Wash	2, 000	0	2, 000	2, 000	0	2, 000	2, 000
81-T-302—Salt Test Facility, site undetermined	(1)	0	6, 800	6, 800	−6, 800	0	0
80-ES-12—Near-Surface Test Facility, Phase II, Richland, Wash	11, 850	8, 275	3, 576	3, 576	0	3, 576	11, 850
80-H-01—First Technology Demonstration Repository, site undetermined	(1)	0	0	0	+6, 000	6, 000	6, 000
81-H-02—Second Technology Demonstration Repository, site undertermined	(1)	0	0	0	+2, 000	2, 000	2, 000
81-H-03—High Level Waste, Solidification Demonstration Facility, site undetermined	(1)	0	0	0	+1, 000	1, 000	1, 000
Total construction, civilian waste management					+2, 200	14, 576	

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATIONS—Continued

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS—Continued

[In thousands of dollars]

Project No. and description	Total estimated cost	Previous authority	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fiscal year 1981
NUCLEAR ENERGY							
Breeder Reactor System							
Liquid Metal Breeder Reactor							
81-T-310—General Plant Projects	11, 500	0	11, 500	11, 500	−3, 500	8, 000	8, 000
78-1c—Safeguards and Security Improvements	12, 000	9, 000	3, 000	3, 000	0	3, 000	12, 000
78-6-f—Fuels and Materials Examination Facility, Richland, Wash	180, 000	83, 200	52, 000	52, 000	+10, 000	62, 000	145, 200
81-T-311—Support Services Building, HEDL, Wash	(1)	0	0	0	+1, 000	1, 000	1, 000
81-T-312—GPP—Test Reactor Area, radioactive and non-radioactive liquid waste systems, Phase II, INEL, Idaho	(1)	0	0	0	+800	800	800
78-6-e—Liquid Metal Engineering Center Modifications, Santa Susanna, Calif. (ETEC)	20, 900	13, 500	0	0	+7, 400	7, 400	20, 900
Total construction, Nuclear energy					+15, 700	82, 200	
FUSION ENERGY							
80-MF-3—Elmo Bumpy Toros, site undetermined	75, 000	2, 000	34, 900	32, 400	+7, 100	42, 000	44, 000
81-MF-2—Impurity Studies Experiment Modification (ISX-C), Oak Ridge, Tenn	20, 000	0	0	0	+10, 000	10, 000	10, 000
81-T-313—General Plant Projects, Princeton Plasma Physics Lab., N.J., and Oak Ridge, Tenn	4, 400	0	5, 400	5, 400	−1, 000	4, 400	4, 400
78-3-a—Mirror Fusion Test Facility, LLL, Calif	(1)	94, 200	0	0	+6, 000	6, 000	124, 200
76-5-a—Tokamak Fusion Test Reactor, Princeton, N.J	278, 600	238, 600	45, 000	45, 000	−5, 000	40, 000	278, 600
78-3-b—Fusion Material Irradiation Test Facility, Richland, Wash	104, 250	31, 300	79, 850	79, 850	−22, 250	57, 600	88, 900
81-MF-1—Fusion Engineering Test Facility, site to be determined	(1)	0	0	0	+4, 000	4, 000	7, 000
81-MF-3—Fusion Research Center, Massachusetts Institute of Technology, Boston, Mass	(1)	0	0	0	+200	200	200
80-MF-4—Large Coil Test Facility, Phase 1, Oak Ridge, Tenn	16, 950	10, 450	6, 500	6, 500	0	6, 500	16, 950
Total construction, magnetic fusion					−950	170, 700	
BASIC ENERGY SCIENCES							
80-ES-10—Chemicals and Materials Sciences Laboratory, Lawrence Berkeley Lab, Berekley, Calif	12, 600	6, 300	6, 300	NC	−6, 300	0	6, 300
81-E-304—Accelerator Improvements and Modifications, Oak Ridge National Lab, Oak Ridge, Tenn	200	0	200	NC	0	200	200
81-E-301—General Ppant Projects, various locations	300	0	300	NC	0	300	300
Total construction			6, 800		−6, 300	500	

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATIONS—Continued

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS—Continued

[In thousands of dollars]

Projected No. and description	Total estimated cost	Previous authority	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fiscal year 1981
GENERAL PURPOSE FACILITIES							
81-E-308—Energy Systems Research Laboratory (ESRL), Oak Ridge National Lab, Tenn. (design only)	2,000	0	2,000	NC		2,000	1,000
81-E-309—Rehabilitation of General Purpose Physical Plant, Argonne, Ill	15,100	0	15,100	NC	−5,000	10,100	10,100
81-E-310—Transmission and Distribution Systems Upgrading, Richland, Wash	12,000	0	12,000	NC	−5,950	6,050	6,050
81-E-311—Energy Science and Technology Building Expansion, Brookhaven National Lab, Upton, N.Y	12,000	0	12,000	NC	0	12,000	12,000
81-E-312—Environmental and Engergy Technology Facility, Richland, Wash	18,000	0	18,000	NC	−14,000	4,000	4,000
81-E-313—Central Energy Conservation Facility, Brookhaven National Lab, Upton, N.Y	9,100	0	9,100	NC	−2,000	7,100	7,100
81-E-314—Energy Utilization Improvements, Brookhaven National Lab, Upton. N.Y	2,000	0	2,000	NC	0	2,000	2,000
81-E-315—Centralized Cogeneration with Chilled and Hot Water Distribution. Argonne National Lab. Argonne, Ill	7,400	0	7,400	NC	0	7,400	7,400
81-E-316—"Boiler No. 3" Replacement, Brookhaven National Lab, Upton, N.Y	3,000	0	3,000	NC	0	3,000	3,000
81-E-317—INEL Roof Replacement, Idaho National Engineering Laboratory, Idaho	4,300	0	5,300	NC	−1,000	4,300	4,300
81-E-318—Upgrade Primary Substation Oak Ridge National Laboratory, Tenn	3,500	0	3,500	NC	0	3,500	3,500
81-E-319—Installation of Coal-Fired Atmospheric Fluidized-bed Boiler Argonne National Lab, Ill	7,100	0	7,100	NC	0	7,100	7,100
81-E-320—Central Supply Facility, Argonne National Lab, Ill	8,500	0	8,500	NC	−8,500	0	0
81-E-321—Site Utilities Project Lawrence Livermore Lab, Calif	7,900	0	7,900	NC	0	7,900	7,900
81-E-322 — Scoville Substation Distribution System Upgrade, Idaho National Engineering Lab, Idaho	1,000	0	1,000	NC	0	1,000	1,000
81-E-323—Fire Safety Improvements Argonne National Lab (ANL-East and West)	4,100	0	4,100	NC	0	4,100	4,100
81-E-324—Fire Safety and Protection Improvements, Idaho National Engineering Lab, Idaho	4,400	0	4,300	NC	0	3,400	3,400
81-H-08—Energy Technology Building Sandia Laboratory, Albuquerque, N. Mex	(1)	0	0	0	+1,000	1,000	1,000
Total construction					−35,450	85,950	

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATIONS—Continued

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS—Continued

[In thousands of dollars]

Projected No. and description	Total estimated cost	Previous authority	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fiscal year 1981
HIGH ENERGY PHYSICS							
81-E-218—Tevatron, Phase I, Fermi National Accelerator Lab, Batavia, Ill	39, 500	0	39, 500	NC	−12, 500	27, 000	27, 000
81-E-219—Accelerator Improvements and Modifications, various locations	6, 000	0	6, 000	NC	0	6, 000	6, 000
81-E-220—General Plant Projects, various locations	5, 000	0	5, 000	NC	0	5, 000	5, 000
79-9-b—Energy Saver, Fermi National Accelerator Lab. Batavia, Ill	46, 600	27, 000	19, 600	NC	0	19, 600	46, 600
78-10-b—Intersecting Storage Accelerator (ISABELLE) 400x 400 GeV, Brookhaven National Lab, Uptown, N.Y	275, 000	78, 500	196, 500	NC	−131, 500	65, 000	143, 500
Total Construction					−144, 000	122, 600	
NUCLEAR PHYSICS							
81-E-222—General Plant Projects, various locations	2, 800	0	2, 800	NC	0	2, 800	2, 800
81-E-223—Argonne Tandem-linac Accelerator System (ATLAS) Agronne National Lab, Argonne, Ill	6, 900	0	6, 900	0	−6, 500	400	400
80-GS-5—National Superconducting Cyclotron Laboratory, Michigan State University East Lansing, Mich	30, 000	6, 000	24, 000	NC	−15, 100	8, 900	14, 900
81-E-221—Accelerator Improvements and Modifications, various Locations	1, 600	0	1, 600	NC	0	1, 600	1, 600
Total construction					−21, 600	13, 700	
URANIUM ENRICHMENT—ADVANCED ISOTOPE SEPARATION TECHNOLOGY							
81-T-501—Isotopes Research and Development Laboratory, Los Alamos, N. Mex	16, 000	0	16, 000	NC	−14, 500	1, 500	1, 500
81-T-502—Advanced Isotope Separation Laboratory, Livermore, Calif	29, 700	0	29, 700	NC	−27, 900	1, 800	1, 800
81-T-504—General Plant Projects, various locations	2, 970	0	2, 970	NC	0	2, 970	2, 970
78-5-c—Laser Isotope Separation Facility, Richland, Wash	(1)	3, 500	0	0	+1, 000	1, 000	4, 500
Total construction					−41, 400	7, 270	

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATIONS—Continued

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS—Continued

[In thousands of dollars]

Projected No. and description	Total estimated cost	Previous authority	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fiscal year 1981
URANIUM ENRICHMENT ACTIVITIES							
81-R-501—General Plant Prpjects, various locations	17, 500	0	17, 500	NC	0	17, 500	17, 500
81-R-502—UF^6 Cylinders and Storage Yards, gaseous diffusion plants	8, 000	0	8, 00	NC	0	8, 000	8, 000
81-R-503—Utilities Upgrading, gaseous diffusion plants	27, 000	0	27, 000	NC	0	27, 000	27, 000
81-R-504—Supervisory Control and Data Acquisition Systems, Paducah, Ky. and Portsmouth, Ohio, gaseous diffusion plants	13, 000	0	13, 000	NC	0	13, 000	13, 000
81-R-505—Instrumentation for Purge Cascades and Withdrawal Areas, gaseour diffusion planst	6, 000	0	6, 000	NC	0	6, 000	6, 000
81-R-506—Environmental Protec-Phase I, gaseous diffusion plants	55, 000	0	55, 000	NC	−19, 000	36, 000	36, 000
80-UE-1—Control of Gaseous Effluents, gaseous diffusion plants, Oak Ridge, Tenn. and Paducah, Ky	7, 000	2, 300	4, 700	NC	0	4, 700	7, 000
80-UE-2-Control of Water Pollution, gaseous diffusion plants	17, 000	7, 500	9, 500	NC	0	9, 500	17, 000
80-UE-3—Plant Facilities Security Improvements, gaseous diffusion plants	17, 000	4, 500	12, 500	NC	0	12, 500	17, 000
80-UE-4—Power Recovery Demonstration Cells, gaseious diffusion plants	10, 500	3, 500	7, 000	NC	0	7, 000	10, 500
80-UE-5—Motor and Switchgear Upgrading, gaseous diffusion plants	28, 500	7, 900	20, 600	NC	0	20, 600	28, 500
76-8-g—Enriched Uranium Production facilities, Portsmouth, Ohio	1, 121, 630	835, 305	286, 325	NC	−170, 000	116, 325	951, 630
71-1-f—Process Equipment Modifications, gaseous diffusion Plants	990, 000	1, 081, 600	0	−20, 000	−111, 600	−111, 600	970, 000
Total uranium enrichment activities					−300, 600	166, 525	

(1) Undetermined

PROJECT 80–G–1, GEOTHERMAL POWER PLANT PROJECT, VALLES CALDERA, N. MEX.

Fiscal year 1981 authorization	$8, 911, 000
Total cost estimate	$127, 216, 000

Purpose

The principal purpose of this project is the design, construction, and operation of a commercial-scale geothermal flash-steam powerplant which utilizes a liquid-dominated hydrothermal reservoir in the United States in furtherance of the federal geothermal program goal.

The goal of the Federal Geothermal Program is to accelerate commercial development of geothermal energy in an environmentally sound manner. The objectives of the demonstration plant are to provide information on the economic, technologic, and environmental aspects of electrical generation from liquid-dominated geothermal resources. Current geothermal technology in the United States is based on the generation of electricity from a vapor-dominated resource and the use of liquid-dominated resources for non-electrical applications. Since almost all of the geothermal resources in the United States are likely to be liquid-dominated and since the development risks of liquid-dominated resources are not well known, this demonstration is aimed at enhancing development of electrical production from the major portion of the U.S. geothermal resource.

Specific objectives are as follows:

demonstrate the social and environmental acceptability and the readiness of state-of-the-art technology for the production of electrical power using a low-to-moderate salinity liquid-dominated hydrothermal resource,

demonstrate reservoir performance characteristics of a specific liquid-dominated hydrothermal reservoir,

demonstrate the validity of reservoir engineering estimates of reservoir productivity (capability and longevity),

demonstrate flash-steam conversion system technology at commercial scale,

provide Federal assistance needed to initiate development at a resource of large potential,

act as a pathfinder for the regulatory process and other legal and institutional aspects of geothermal development, and

provide a basis for the financial community to estimate the risks and benefits associated with geothermal investments.

Facility Description

The project provides for the design, construction, and operation of a commercial-scale geothermal eelctric power plant which utilizes a liquid-dominated hydrothermal reservoir. The project consists of geothermal well field development, power plant and transmission construction, and operation of a 50MW(e) electrical generating facility.

The demonstration plant will be located within the Valles Caldera at Baca Location No. 1 in north-central Sandoval County N.M. The well field and plant sites are approximately 96 km (60 miles) north of Albuquerque and 30 km (19 miles) west of Los Alamos. The lands comprising the original Baca Location No. 1 Land Grant are owned by the U.S. Forest Service and National Park Service (4 percent), by Dunigan Enterprises and the Baca Land and Cattle Company (96 percent), and by the Los Alamos Ski Club (less than 1 percent).

The steam supply system consists of geothermal wells, piping, steam separators, and a liquid injection system. During operation, fluid will be transported through pipelines from wellheads to localized or "satellite" flash separators, from which steam will be piped to the power plant and gases will be removed from the geothermal fluid in the turbine condenser and processed through a hydrogen sulfide abatement system prior to release of the gases to the atmosphere. A total of 14–17 geothermal wells will be required, depending on drilling success.

The power plant is a single-flash steam unit, generating 50 MWe gross from 710 kPa (103 psi) steam, and from the standpoint of power cycle design will be similar to the closed-condenser system now being designed and constructed at the Geysers in Northern California, where only steam reaches the turbine from the wells. The power plant consists of a turbine generators building, cooling tower, hydrogen sulfide abatement system, and an electrical switchyard.

Electricity will be transmitted from the plant by a 115-kV transmission line which will connect the plant site to the TR-3 substation near Los Alamos.

Project Status (April 1980)

In fiscal year 1980, plant construction will be completed. The fluid supply and injection system will be completed and tested. Qualification testing will be initiated with completion scheduled for the first quarter of fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1978	11. 951	11. 951	11. 951
1979	7. 028	7. 028	7. 028
1980	20, 450	10, 450	20, 450
1981	8, 911	8, 911	8, 911
1982	5, 876	5, 876	5, 876

PROJECT NO. 80-G-2, SECOND 50 MWE DEMONSTRCTION POWERPLANT, SITE TO BE DETERMINED

Fiscal year 1981 authorization	$10, 000, 000
Total cost estimate	Undetermined

Purpose

The principal purpose of this project is the design, construction, and operation of a commercial-scale geothermal binary electric powerplant which utilizes a liquid-dominated hydrothermal reservior in the United States in furtherance of the Federal geothermal program goal. This is intend to provide maximum stimulus to non-Federal development in the United States of the widest spectrum of liquid-dominated hydrothermal resources unsable for electric generation.

The project goal is to demonstrate that the production of electric power from moderate temperature geothermal resources in the United States using a binary conversion system can be economical and environmentally and socially acceptable. The goal is to produce power that is competitive in price to other conventional nuclear or fossil power sources in the midterm.

Project Description

The geothermal demonstration binary powerplant project will consist of the design, construction, and operation of a powerplant to convert the heat content of the Heber liquid-dominated hydrothermal geothermal reservior into electric power. The project will also include associated reservior evaluation. The plant will be used to collect statistically reliable engineering and cost data on reservior performance and on plant construction, operation and maintenance for a 2-year period to determine and demonstrate predictable, technical, economic, and environmental performance with acceptable risk at a commercial prototype scale.

The plant will be an integrated commercial-scale, geothermal electric power generating plant producing 45 MWe net (65 MWe gross). An integrated plant includes the geothermal field system, fluid production equipment, fluid transmission system, conversion system, electric generating plant, geothermal fluid treatment and spent fluid disposal disposal facilities and a terminal connection to the Imperial Irrigation District electric utility transmission network. The plant generating system will use only geothermal energy as the heat source for power generation and binary system conversion technology. The hot geothermal fluid from the pumped production wells flows through the tube side of shell-and-tube heat exchangers, where its useful heat energy is transferred to the binary cycle working fluid. The cooled geothermal fluid is discarded by pumping into injection wells. The binary working fluid is vaporized in the heat exchanger and used to drive a turbine/generator in a simple Rankine cycle. Waste heat is rejected using a wet cooling tower.

Project Status

Conceptual design and initial engineering has been started.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	4, 000	4, 000	2, 237
1981	8, 857	8, 857	8, 857
1982	20, 643	20, 643	20, 643
1983	9, 052	9, 052	9, 052
1984	1, 300	1, 300	21, 300
1985	0	0	0
1986	0	0	0
1987	0	0	0

PROJECT 81-T-301, GENERAL PLANT PROJECT, RICHLAND, WASH.

Fiscal year 1981 authorization	**$2, 000, 000**
Total estimated cost	**$2, 000, 000**

Purpose

This project provides for minor new construction and other capital alternations, additions, retirements to the land, and improvements to buildings and utility systems required annually for continuity of operation, elimination of health, safety and fire hazards and support for improved and more economical operations. This request includes the cost of installed equipment which is an integral part of the general plant projects.

Facility Description

The Department did not submit specific projects that would be accomplished in fiscal year 1981.

Project Status

This is a new start in fiscal year 1981.

PROJECT 80–ES–12, NEAR SURFACE TEST FACILITY, PHASE II, RICHLAND, WASH.

Fiscal year 1981 authorization	**$3,576,000**
Total estimated cost	**11,850,000**

Purpose

Phase II of this facility will provide the capability to perform in-situ tests in basalt with encapsulated spent fuel and vitrified commercial high-level waste. These tests will demonstrate the suitability of basalt as a geologic repository medium, aid repository design and development, and confirm the ability to simulate thermal input to basalt with electric heaters. Emplacement and retrieval of spent fuel and vitrified commercial high-level waste from an underground basalt environment will also be demonstrated.

The Phase II testing program will consist of a nominal five-year test period in which encapsulated commercial spent fuel and vitrified commercial high-level waste will be emplaced, using a remote handling system, in the basalt. Extensive instrumentation will provide thermal-mechanical and radiation effects data, which will be recorded, processed, and analyzed by an on-site data acquisition system. Post-test geologic characterization and facility decommissioning (including removal of all spent fuel and vitrified commercial high-level waste) will occur subsequent to test completion.

Facility Description

The Near-Surface Test Facility (NSTF) provides for the construction of a new multi-purpose test facility on the Hanford Site for in-situ testing of basalt. Phase II of this project comprises that portion of the facility that will house the nuclear waste test area.

The NSTF is to be located on the west end of Gable Mountain on the Hanford Site near Richland, Washington. When completed, the total facility will consist of approximately 3,000 linear feet in underground workings, including access tunnels, test rooms, and an instrumentation room, with a computer room located at the entrance to the access tunnels. The nuclear waste phase (Phase II) will require the excavation of 25,000 cubic yards of material from the portal area and 1,200 feet of underground excavation. This portion of the facility will be separated from the Phase I facility area (electrical heater testing) by a series of air locks and will have its own ventilation system. A vertical shaft is to be developed from the surface of Gable Mountain to the Phase II test room to provide the independent ventilation requirements.

Project Status

Phase I construction has been completed and Phase II design initiated.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
Prior years	1.141	1,141	1,141
1979	3.533	3.533	3.533
1980	3.6	3.6	3.6
1981	3.576	3.576	3.576

PROJECT 81-H-01, FIRST TECHNOLOGY DEMONSTRATION REPOSITORY, SITE UNDETERMINED

Fiscal year 1981 authorization	$6,000,000
Total estimated cost	Undetermined

Purpose

This project is intended to prove the feasibility of nuclear waste disposal in deep geological facilities.

Facility Description

The project includes the use of existing geological data to select a suitable site for demonstrating the technology for mined repositories for disposal of high-level wastes. Candidate sites are to be selected on the basis of geological formations, location, land ownership (federal or private) and similar considerations. Site identification is to be based upon use of engineered barriers, including waste solidification and "overpack" canisters, to contain wastes until they are as safe as uranium ore mined for the purpose of producing nuclear fuel.

Constrction of the facilities will include excavation of shafts for site characterization. For accepted sites, additional construction would include working tunnels at depth, surface facilities, waste handling equipment ventilation machinery utilities and roads.

Project status

This is a new start in fiscal year 1981.

Financial Schedule

To be determined.

PROJECT 81-H-02, SECOND TECHNOLOGY DEMONSTRATION REPOSITORY, SITE UNDETERMINED

Fiscal year 1981 authorization	$2,000,000
Total estimated cost	Undetermined

Purpose

This project is intended to prove the feasibility of nuclear waste disposal in deep geological facilities, either in a similar geological formation as the First Technology Demonstration Repository, or in a different geological formation.

Facility Description

This project includes the use of existing geological data to select a suitable site for demonstrating the technology for mined repositories for disposal of high-level wastes. Candidate sites are to be selected on the basis of geological formations, location, land ownership (federal or private) and similar considerations. Site identification is to be based upon use of engineered barriers, includin waste solidification and "overpack" canisters, to contain wastes until they are as safe as uranium ore mined for the purpose of producing nuclear fuel.

Construction of the facilities will include excavation of shafts for site characterization. For accepted sites, additional construction would include working tunnels at depth, surface facilities, waste handling equipment, ventilation machinery utilities and roads.

Project Status

This is a new start in fiscal year 1981.

Financial Schedule

To be determined.

PROJECT 81-H-03, HIGH LEVEL WASTE SOLIDIFICATION DEMONSTRATION FACILITY SITE UNDETERMINED

Fiscal year 1981 authorization	$1,000,000
Total estimated cost	Undetermined

Purpose

This project is intended to demonstrate production of solidified monoliths of vitrified high-level radioactive wastes on an intermediate scale of production.

Facility Description

This project is intended to build upon past initial pilot-scale production of monoliths of vitrified high-level wastes. It is to provide demonstration of production technology in advance of future large-scale production facilities now being planned. Government-owned wastes are to be used. The location of the facility is to be chosen to provide convenience and economy in this technology demonstration. Factors to be included in the selection of the site and the construction of the facility are the physical form of the waste (calcine, salt-cake, or liquid), the methods for removal of these wastes from their storage and the existence of any adaptable facilities that have shielding and remote handling equipment.

Construction of the facilities will include selection of the site or sites, construction of equipment, any needed structure for removal of the wastes from storage, acquisition of any required equipment for transporting the wastes to the vitrification facility, construction of a facility for calcining if required, and construction of vitrification facilities.

Project Status

This is a new start in fiscal year 1981.

Financial Schedule

To be determined.

PROJECT 81-T-310, GENERAL PLANT PROJECTS, BREEDER REACTOR SYSTEMS

Fiscal year 1981 authorization	$8,000,000
Total estimated cost	11,500,000

Purpose

The estimate is based on the requirement of the various operating offices, cited below:

Chicago Operations Office.

Fast Flux Test Facility Project Office/Hanford Engineering Development Lab

Idaho Operations Office.

San Francisco Operations Office.

The estimate for FY 1981 general plant projects is generally below amounts funded in prior years. It takes into account new plant and other facilities which are coming into operation, plus certain special nonrecurring projects which fall within the criteria for general plant projects.

In the past, work under general plant projects has included modifications or improvements to existing buildings and other facilities, additions to buildings to house new machinery, equipment and personnel, construction of small new buildings, replacement or additions to roads and utility lines, and general area improvements. Continued support of general plant projects of this type is necessary to meet new and continuing needs of production, research and development programs, and to provide for safe and economical operations.

Facility Description

Projects under consideration include: EBR-II 2400 V Electrical System Rehabilitation Rehabilitate Criticality Alarm System, ANL-W Rehabilitate Main Power Supply Lines, ANL-E Replace Steam Flow meters, ANL-E, Magnetic Resonance Laboratory, ANL-E, HFEF/S Radioactive Liquid Waste Process System, Radioactive Liquid Waste Disposal, Bldg 3730, 2400 V Distribution System, 300 Area.

Other projects are also included. The Department of Energy is to evaluate the priorities and select those projects which are most important for construction.

Project Status

These projects would be new starts in fiscal year 1981.

PROJECT 79-1-C, SAFEGUARDS AND SECURITY IMPROVEMENTS, RICHLAND, WASH.

Fiscal year 1981 authorization	$3,000,000
Total estimated cost	12,000,000

Purpose

Work on the 400 area was initiated in 1967 with the construction start on the FFTF. The area is planned to be an integrated complex of special purpose research and development facilities. The major facilities planned include the FFTF, the Fuels and Materials Examination Facility (FMEF), the Fuel Storage Facility (FSF), and the Maintenance and Storage Facility (MASF).

This project provides the upgrading to the existing security system serving the 300 area necessary to ensure compliance with applicable government guidelines and to provide a more secure area commensurate with protecting the special nuclear material (SNM) in the area.

The importance of the FFTF and its immediate support of the overall breeder reactor development program dictates a need for implementation of stringent and effective security controls. Protection of the facilities and SNM from both covert and overt threats makes it essential to maintain control of all personnel and materials that enter or leave the security areas and that the facilities and material be afforded adequate safeguarding through the use of an adequate, cost effective security system. This project provides the security improvements needed in the 400 area.

Facility Description

The project entails construction of new fences, continuous electronically monitoring fence alarms, lighting, guard stations, material transfer station (including delivery vehicle inspection), roads, (300 area) security operations support building, closed circuit TV and door alarm systems and a 400 area emergency control center. The project included addition of new structures and addition of the security features to buildings in use so as to realize integrated mutually supporting security and safeguards facilities and systems for the 300 and 400 areas.

Project Status

Work has proceeded with modifications of perimeter security, measures, reinforcement of guard buildings, detection systems and alarms. Several areas remain to be upgraded.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1979	4.5	4.5	4.5
1980	4.5	4.5	4.5
1981	3.0	3.0	3.0

PROJECT 78-6, FUELS AND MATERIALS EXAMINATION FACILITY, RICHLAND, WASH.

Fiscal year 1981 authorization	**$62,000,000**
Total estimated cost	**180,000,000**

Purpose

FMEF is needed to establish the performance of fuel, blanket, absorber and material tests for the Fast Flux Test Facility (FFTF). FMEF is to be constructed about 1,000 feet west of the FFTF reactor at Hanford.

With the FFTF becoming operational and with the emphasis on the fuel development program to develop alternate proliferation resistant fuel, the need for the FMEL capabilities is critical. Many of the candidate fuels require development of remote fabrication techniques. Also, the many types of fuel assemblies which must be fabricated and examined will require greater facility flexibility and handling capability than is currently available in the United States. Tests which must be performed on fuels, blanket and absorber pins will be increased as a results of: (a) assemblies of diverse types of candidate fuels, and (b) the larger prototype assemblies tested in the FFTF.

The criteria which determined the facility size are based upon the programmatic need to develop remote fabrication techniques, and to fabricate and postirradiation examine FFTF fuels and material tests.

Prior to the FMEF becoming operational, HEDL will procure approximately $23,500,000 million of developmental fuel fabrication equipment from equipment funds.

Description of facilities

The fuels and materials examination facility (FMEF) will be a multilevel fuels development building with mechanical, electrical, and maintenance areas grouped around the central cell complex, adjacent support buildings and other necessary structures. The following is a description of these facilities.

The process building will consist of the high-density shielded cell complex for proliferation resistant fuels and materials fabrication development and postirradiation examination. The complex includes nondestructive and destructive examination cells, fuels fabrication development cells and associated supporting areas. Laboratory space will be provided to fabricate FFTF fuel experiments and to consolidate HEDL radioactive analytical chemistry functions.

Operational support areas such as cell and building service equipment, laboratories, data reduction and storage space, offices and personnel spaces, surround the cell complex. Space will be provided for a neutron radiography reactor and for computers. The shipping and receiving areas will include crane capability for handling fuel and material shipping casks and equipment being loaded or off-loaded.

The process building will be constructed to meet tornado, seismic, safeguards, radiation protection and other requirements in accordance with appropriate DOE criteria.

Ancillary buildings provide supporting facilities for the operating staff and space for equipment and patrol personnel to monitor and control access of personnel and equipment into the process building and its surrounding area.

Utilities will include sanitary sewer, water, process and contaminated waste lines, electrical feeders, railroads, and outdoor substation and will be provided in accordance with applicable codes and criteria.

Improvements to the land will include site grading, drainage diversion, security fence, lighting and paving of roadways, walkways and parking lots.

Project status

The Process Building lower level design has been completed. The Process Building shell has been designed. The excavation has been completed. The DE Cell liner contract was awarded. The dismantling machine conceptual design was completed. The "below grade" general contract was awarded. Prototype equipment testing was started. The large equipment transporter conceptual design was completed.

FINANCIAL SCHEDULE

Fiscal year	Authorizations	Appropriations	Obligations
Prior years	$30, 200	$30, 200	$30, 200
1980	53, 000	53, 000	53, 000
1981	52, 000	51, 000	52, 000
1982	34, 800	34, 800	34, 800
1983	0	0	0
1984	0	0	0

PROJECT 81-T-311, SUPPORT SERVICES BUILDING, HANFORD ENGINEERING DEVELOPMENT LABORATORY, WASHINGTON

Fiscal year 1981 authorization	$1, 000, 000
Total estimated cost	Undetermined

Purpose

To provide the essential facilities at the Fast Flux Test Reactor which will enable site essential administrative duties to be performed.

Facility Description

To be determined based on minimum costs consistent with functional needs.

Project Status

This is a new start in fiscal year 1981.

Financial Status

The $10,000,000 authorized is to permit the initiation of engineering for Title I A/E services and beginning Title II design in fiscal year 1981.

PROJECT 81–T–312, GENERAL PROJECT, IDAHO

Fiscal year 1981 authorization	$800,000
Total estimated cost	Undetermined

Purpose

The project is to enable the design and construction of a waste treatment system capable of removing and confining tritium.

Facility Description

Engineering work in process will determine the configuration of the system, the components required, and instrumentation.

Project Status

This is a new start in fiscal year 1981.

PROJECT 78–6e, LIQUID METAL ENGINEERING CENTER, MODIFICATIONS, SANTA SUSANA, CALIF.

Fiscal year 1981 authorization	$7,400,000
Total estimated cost	20,900,000

Purpose

To enable the full-scale testing of the next generation liquid metal pumps for future breeder reactor projects. This project is scheduled to be compatible with the first prototype 1,000 MWE reactor.

Description of Facility

The project will consist of the modification of existing facilities and the installation of new larger diameter piping, valves, controls, and instruentation as well as a pump mounting structure to accommodate pumps in the size range of 100,000 gpm.

Project Status

This phase of project 78–6–e represents a new start for fiscal year 1981. Previous modifications have been installed.

PROJECT 80–MF–3, ELMO BUMPY TORUS PROOF OF PRINCIPLES SITE TO BE DETERMINED

Fiscal year 1981 authorization	$42,000,000
Total estimated cost	75,000,000

Purpose

EBT has been judged in DOE reviews to be a very attractive reactor system with several factors that avoid some of the perceived problems of tokamak reactors. An EBT offers the potential for a steady-state, high beta, ignited reactor with very little recirculating power. The EBT is inherently a large aspect ratio device which provides good access for heat removal and maintenance. In addition, it has superconducting magnets and utilizes high frequency microwave energy input to create the stabilizing high beta electron rings and provide plasma heating.

The objective of the EBT-P program is to achieve a (hydrogen) plasma confinement experiment in which nearly all the relevant physics parameters such as collisionality, beta, etc., are either near enough to the reactor plasma regime or substantially greater than EBT-S parameters to allow a reasonable extrapolation in evaluation of reactor potential. The project is scheduled for start in FY 1980 and experimental operations are to begin by the end of FY 1984.

Description of project

A decision is to be made as to whether a new building will need to be constructed or leased. The reactor is a hybrid combining both mirror and Tokamak features. This configuration may prove to offer attractive reactor potential.

Project status

Requests for proposals have been sent to industry. Design definition has been completed.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	9,100	2,000	2,000
1981	7,900	7,900	7,900
1982	58,000	34,100	34,100
1983	0	24,000	24,000
1984	0	7,000	7,000

PROJECT 81-MF-2, IMPURITY STUDIES EXPERIMENT (ISX-C) OAK RIDGE, TENN.

Fiscal year 1981 authorization	**$10,000,000**
Total estimated cost	**20,000,000**

Purpose

To investigate long pulsed plasma performance and advanced impurity control techniques. This data is essential for the design of the Fusion Engineering Test Facility.

Project description

This will be a scaled up version of the ISX experiment and will make useof all existing power supplies and diagnostics. This will be a Kamak device.

Project status

Conceptual design is just beginning.

Financial schedule

No schedule has been prepared as yet since this is a new start. However, the procurement of magnets and additional power supplies in FY 81 is essential for timely project completion compatable with the national fusion program.

PROJECT 81-T-313, GENERAL PLANT PROJECTS, OAK RIDGE, TENN.

Fiscal year 1981 authorization	$4,400,000
Total estimated cost	4,400,000

Purpose

General Plant Projects are used mostly to carry out small maintenance, repair, modification and upgrading plant and capital work in order to maintain property, meet new requirements or correct deficiencies in facilities.

Project description

The following subprojects are included:

A. Establish a coal program testing facility in building 9401-1	$300,000
B. Temperature and humidity control for computer room, building 3500	30.000
C. Backup alarm center	350,000
D. Chemical engineering laboratory, building 3503	400,000
E. North side improvements—Central Avenue	100,000
F. Energy division office building	375,000
G. Realinement and improvements to First Street	425,000
H. Upgrade electrical distribution system, building 9201-3	150,000
I. Upgrading of steam and condensate piping system, building 9204-1	250,000
J. Improve safety of trailer and bottle gas shortage area, 4500	230,000
K. Increase efficiency of air handling units for building 9207 and 9210, Y-12	450,000
L. Replace heating system to conserve energy, building 9764	170,000
M. Well water supply for ecological experiments, ORNL permanent water line from building 1504 to building 1503	60,000
N. Clean room facilities	60,000
O. Install electrical substation for increased experimental needs, building 9204-1	150,000
P. Improvements at Bethel Valley-Scarboro Roads intersection	500,000
Total	4,000,000

PROJECT 78-3-A MIRROR FUSION TEST FACILITY, LAWRENCE LIVERMORE, CALIF.

Fiscal year 1981 authorization	$6,000,000
Total estimated cost	Undetermined

Purpose

A recent succession of experimental and theoretical advances with magnetic mirror systems has provided the impetus for a significant expansion in this program area. Problems pertaining to energy scaling, startup in a steady-state magnetic field and control of microinstabilities have all been explored with favorable results. Based on the aforementioned results, it is now proposed to proceed with a new regime of experimentation through the mirror fusion test facility. The test apparatus in the facility will provide the foundation to extend mirror physics parameters significantly beyond those of present experiments and serve when coupled with appropriate device components, and the generic engineering information from the ETF as the basis for subsequent candidatte designs for the demonstration reactor.

Project Description

This project provides: (1) for modification of an existing building to house a magnetic mirror test device; (2) for fabrication and installation of major components to comprise the mirror test apparatus; and (3) for construction of laboratory and office space with approximately 100,000 gross square feet.

The research device will be housed in an existing building which will require some modifications; i.e., relocation of existing shielding block walls to enlarge the existing shielded pit, reinforcement of the pit foundations, removal of existing experimental apparatus, and extension of one end. The test apparatus will consist of the superconducting magnet system, the vacuum system, the liquid helium cryoplant, the power distribution system, the support structure, diagnostics and machine controls. When these items are fabricated and assembled, the capability to produce a magnetic field, a vacuum and high voltage power will be provided for use in the performance of mirror-confined fusion experiments. First activities in this test device will involve prototype development, testing and evaluation of plasma streaming gun systems, startup neutral beam systems, sustaining neutral beam modules, magnet warm liners, source isolation valves, beamline ducts and walls. The magnetic mirror apparatus coupled with the proper combination of prototypical components will provide the experimental machine configuration to pursue stated physics goals and objectives.

The fiscal year 1981 authorization expands the original scope of work beyond the original plan by recognizing that a second magnet will permit the opportunity to jump ahead in the development of mirror fusion reactors.

Project Status (December 1979)

The building modification was 70 percent complete. The magnet was still mounted on the winding fixture with work proceeding on schedule. The computer/control facilities were complete with electronic equipment being installed. Construction work on the laboratory/office building has not been started.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1978	94,200	14,000	14,000
1979	0	40,000	39,989
1980	0	28,200	28,200
1981	0	7,000	7,000
1982	2,000	[1]7,000	7,011

PROJECT 76–5–a TOKAMAK FUSION TEST REACTOR
PRINCETON PLASMA PHYSICS LABORATORY

Fiscal year 1981 authorization	$40,000,000
Total estimated cost	278,600,000

Purpose

The TFTR is a major milestone in an extensive program plan which identifies the major steps leading to the operation of a demonstration fusion power reactor early in the next century. Its principal objectives are: (1) to demonstrate fusion energy production from the burning of DT in a tokamak prior to the experimental power reactor(s); (2) to build a tokamak capable of repeated operation on DT fuel in order to: (a) the physics of burning plasmas, and (b) begin engineering studies of DT tokamak systems; (3) to demonstrate engineering features of large fusion systems in advance of construction of an experimental power reactor. The TFTR will serve as an intermediate step to bridge the gap between current, relatively small, hydrogen plasma confinement experiments and larger experimental power reactors. The unique features required are its DT burning capability, its size (which permits physics experiments in the experimental power reactor range of interest), and some of its engineering features, not heretofore tested. The experience to be gained in design, construction, and operation, and the information to be gathered in physics and engineering will provide a sound foundation along with the GYF information for experimental power or demonstration reactor construction.

Project description

The Tokamak Fusion Test Reactor (TFTR) plant facilities will include an experimental high-bay building complex, a motor-generator building, a power equipment building, a power conversion building, an engineering laboratory/office building, and modifications to existing support facilities. Specifically, the experimental high-bay building complex consists of a heavily shielded test cell, an operations wing (hot cell, warm cell, neutral beam test cell, and cold assembly bay) and a control and service wing (equipment area, control room, office and laboratory areas). The hot cell is a well shielded enclosure wherein a wide variety of repair and maintenance functions relating to radioactive material can be accomplished; the warm cell provides for the movement of equipment; the neutral beam test cell provides an environment for testing neutral beam equipment; and the cold assembly bay provides for performing work on nonradioactive materials.

The motor generator building addition is also a high-bay structure. It will contain vertical shaft, motor-driven, low speed, alternating current generators with flywheel energy storage. The power equipment building will house the power sources and electronic equipment for the neutral beam injectors. The power conversion building will house the solid-state power supplies, capacitor banks, high voltage vacuum switches and electronic equipment associated with the device. The engineering laboratory/office building will include centralized computer facilities, laboratories, and office and support areas. Also included in the project facilities are modifications to several existing support buildings (administration building, entrance lobby, auditorium, cafeteria and technician shop). Supporting utility services including process cooling, potable water, sewage, steam, chilled water, light and power will be provided as part of the construction project. A utilities building will be provided to consolidate these systems. Site improvement including general regrading, drainage, excavation, paving, landscaping, fencing and security lighting/detection will be accomplished.

Project status (December 1979)

Construction work is proceeding on current schedules. The office building and control room have been completed. The reactor structure was approximately 70% complete. The motor generator building was structurally complete, both motor generators were on site and one was being installed. The power equipment building was structurally complete. All major systems components were in procurement and capacitors had been delivered to the site.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1976	23,000	15,000	14,067
Transition period	7,000	5,500	5,500
1977	184,600	75,000	44,836
1978	24,000	71,000	85,484
1979	0	42,000	43,865
1980	0	35,000	35,000
1981	45,000	30,000	30,000
1982	0	10,100	24,848

PROJECT 78–3–b, FUSION MATERIALS IRRADIATION TEST FACILITY, RICHLAND, WASH.

Fiscal year 1981 authorization	**$57,600,000**
Total estimated cost	**104,250,000**

Purpose

This project provides for the construction of a new Fusion Materials Irradiation Test Facility (FMITF) that will produce high energy neutrons, representative of fusion reactor conditions, for generating the quantity of irradiation-effects data needed to qualify materials for reactor construction. The FMIT will be located in the 300 Area of the Hanford Reservation. The FMIT is presently conceived as an integrated complex, consisting of:

Accelerator building, housing a linear accelerator to generate a beam of 35 MeV deuterons;

Test building which provides two shielded irradiation test cells, one containing a liquid lithium target which strips the deuterons to produce neutrons and the other unequipped; and

An interconnecting beam transport tunnel.

Improvements to the land will include site grading, paving of roadways, walkways and parking lots, drainage diversion, security fence and area lighting. Utilities will include additions to the existing substations, a new outdoor electrical equipment yard, primary and secondary electrical feeders, water supply, and sanitary sewers.

Project Description

The history of the development of both fast and thermal reactors emphasizes the need for test data concerning irradiation effects on component materials. The materials to be used in fusion power reactors must exhibit long lifetimes in order to ensure the highest reliability and safety combined with the lowest operating cost. Demonstrating the satisfactory performance of these component materials is, therefore, a key goal in the plans for the attainment of commercial fusion power. The adequacy of materials for reactor construction can be determined only by testing under conditions similar to those encountered in a fusion reactor.

As part of the Breeder Reactor program, numerous well-characterized material specimens are being irradiated to provide adequate test data concerning component lifetimes. Although this information is useful for fluences of lower neutron energies (2–4 MeV), the data can be very misleading when extrapolated to higher energies and/or higher fluences. For instance, irradiation of graphie at 750° C initially caused contraction of three to seven percent, but with increasing irradiation the behavior changed to rapid expansion. Only irradiation effects data from experiments on the effect of actual flux intensities can clearly define fusion reactor component lifetime performance. In order to achieve the anticipated materials lifetime fluences of 10^{22} n/cm^2 within a year to permit accelerated testing, maximum flux intensities must be near 10^{15} n/cm^2-sec. A useful irradiation volume on the order of one liter will also be needed to provide the necessary throughput of specimens and quantity of irradiated test data.

Project Status (December 1979)

First construction package was ready for bid. The accelerator prototype building was completed. The experimental lithium system was completed. Title II, Final Design is in progress.

FINANCIAL STATUS

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1978	14, 400	7, 500	7, 500
1979	0	6, 900	6, 900
1980	10, 000	10, 000	10, 000
1981	79, 850	22, 600	22, 600
1982	0	50, 000	50, 000
1983	0	4, 900	4, 900
1984	0	2, 350	2, 350

PROJECT 80–MF–1, FUSION ENGINEERING TEST FACILITY, SITE TO BE DETERMINED

Fiscal year 1981 authorization	$4, 000, 000
Total estimated cost	Undetermined

Purpose

Provide primary physics, engineering, and technology for the entire national fusion energy program. This facility will investigate for the first time the technology needed to translate fusion science into practical power production.

Project description

As presently invisioned the experimental reactor would consist of a tokamak configuration. The major radius will be between 5 and 6 meters and a minor radius of 1 to 2 meters and will use superconducting magnets in the 3 to 5 Tesla range.

Project status

This is a new start in fiscal year 1981.

Financial status

To be planned.

PROJECT 81–MF–3, FUSION RESEARCH CENTER, MIT, BOSTON, MASS.

Fiscal year 1981 authorization	$200,000
Total estimated cost	Undetermined

Purpose

To provide the needed laboratory and office facilities to support the fusion program at MIT.

Description of facilities

The work is to include the modification and renovation of existing facilities making them functionally suitable for the work to be performed. The work will include partitioning, lighting, air conditioning, flooring, electrical modifications and refinishing.

Project status

This is a new start for fiscal year 1981.

PROJECT 80–MF–4, LARGE COIL TEST FACILITY, OAK RIDGE, TENN.

Fiscal year 1981 authorization	$6,500,000
Total estimated cost	16,950,000

Purpose

Large magnetic fields are needed to confine and control the ultrahot plasmas in fusion reactors. Generating these fields requires large amounts of electrical energy when conventional conductor materials, such as copper, are used in the electromagnet windings; in fact, the energy needed is so great that net power production could be jeopardized.

Although it has been necessary and economical to use electromagnets with conventional conductors to confirm theories and develop interim fusion hardware, magnets that consume significantly smaller amounts of energy will be needed for future fusion power facilities. The only practical solution is to develop and utilize superconducting magnets which consume negligible energy.

To develop these magnets, the Large Coil Program is underway to demonstrate the ability to fabricate superconducting coils for fusion power and to demonstrate reliable operation of sufficiently large coils to prove the design principles, materials and fabrication techniques that could be extrapolatable with confidence to fusion power reactor sized. The objective of the LCTF is to provide, in an economic and timely fashion, a framework within which such coils can be tested and reliable operation demonstrated. The LCTF has to be ready to test the various large coils that are being fabricated (three in the U.S. and three by foreign participants (Euratom, Japan, and Switzerland)) as they are delivered in 1981 and 1982. The results will enable a selection of the best features for incorporation into the magnets needed for future large devices and enable good estimates of production costs.

Funds in fiscal year 1981 will be used to complete the test stand, modifications to the refrigerator for forced flow helium cooling, pulsed magnetic field coils, final instrumentation and diagnostic collection systems, coil protection circuits, and power supplies for foreign coils.

Project Description

The Large Coil Test Facility (LCTF) will be a test facility to evaluate superconducting magnet coils for the Magnetic Fusion Energy program and will have the capability of testing "D" shaped 2.5 x 3.5 meter bore superconducting coils singularly and in two, three and six coil toroidal arrays at peak magnetic fields of 8 Tesla. With slight modifications the facility will have the capability of testing at 12 Tesla fields and will accommodate a single large superconducting coil of the size anticipated for the next large tokamak fusion device. Under an IEA agreement, three coils are being supplied for testing from Euratom, Japan and Switzerland.

The facility will be located within an existing building at ORNL and consist of a 35′ diameter by 38′ high cylindrical vacuum tank which will house a coil test stand and the associated cryogenic, electrical, and instrumentation systems to support the test program. The facility will utilize an existing helium refrigerator with a capacity of 1.5 kW at 4.2 K to provide the necessary pool boiling cooling for the superconducting coils, electrical leads and test stand. Additional refrigeration capacity and a forced flow helium cooling system will be provided for the foreign coils. The vacuum vessel provides a liquid nitrogen cold wall and 10^{-4} torr vacuum for thermal isolation of the 4.2 K test array system. Construction is phased so that initial testing of the first two pool boiling helium cooled U.S. coils can begin an March 1981, while further construction continues on providing pulsed magnetic field, forced helium flow and six coil torus capabilities by September 1982.

Project States (May 1980)

Vacuum chamber is complete. First coils (6) are in production. Control and instrumentation is being installed.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1977	66	66	66
1978	1,730	1,730	1,730
1979	6,654	6,654	6,654
1980	2,000	2,000	2,000
1981	6,500	6,500	6,500
1982	0	0	0

PROJECT 81–E–304, ACCELERATOR IMPROVEMENTS AND MODIFICATIONS, OAK RIDGE NATIONAL LABORATORY, TENN.

Fiscal year 1981 authorization	$200,000
Total estimated cost	200,000

Purpose

To fully exploit the use of tandem accelerator facilities for future atomic collisions research, basic improvements which capitalize on the excellent ion sources and instruments available, are badly needed. The ORNL EN-tandem accelerator was originally installed in 1961 and 1962. The facility was planned for nuclear physics research with light ions. Since that time, the facility has evolved to the point that nearly 100 percent of the research is done with heavy ions and approximately 85 percent is atomic physics. Atomic collision experiments concerning highly ionized, heavy ions in various ionization-excitation states require the widest possible variety of heavy ion beams derived from high current sources possessing excellent ion optic beam quality and stability. The tandem laboratory presently possesses ion sources equal to or better than those of any other similar facility in the world. Much of this negative ion source development work was stimulated by the needs of the new tandem accelerator incorporated in the Holifield Heavy Ion Research Facility (HHIRF) but is equally useful for atomic collision research using the EN-tandem. Continued ORNL leadership in fast beam pulse techniques will make experiments possible where a pulsed beam interacts with a coincidentally pulsed high power laser.

The installation of this spectrograph will provide the ability to make very precise energy loss measurements in crystal channeling, in stopping power experiments, and for energy loss measurements in coincidence with inner-shell ionization or excitation, where energies relative to the primary beam energy for different charge states must be determined.

Facility Description

A high resolution magnetic spectrograph capable of energy resolution of E/E 10^{-4} will be installed. This instrument, an Elbek spectrometer, has been obtained from Los Alamos as excess property. A new power supply will be obtained. The camera box will be modified to accommodate position-sensitive detectors. Pumping systems will be installed, and the detectors interfaced to the data acquisition system.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	0.200	0.200	0.200
1982	0	0	0
1983	0	0	0

PROJECT 81–E–301, GENERAL PLANT PROJECTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$300,000
Total estimated cost	300,000

Purpose

This project is required to provide for minor new construction, other capital alterations and additions, and for buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and usefulness of DOE-owned facilities. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and changes in the currently planned subprojects. In general, the estimated funding for each location is preliminary in nature, and is intended primarily to indicate the relative magnitude of the requirements.

Facility Description

The following are examples of the major items of work to be performed at the various locations:

Ames Laboratory	$275

Requirements include: upgrade of the campus warehouse roof ($76,700); energy conservation modifications to the Development Building Laboratory Wing ($15,800); addition of isolation valves on the utility risers of the Development Building ($13,200); humidity generator upgrade for Spedding Hall and the Metallurgy and Development Buildings ($39,700); upgrade of distilled water generating equipment ($33,000); installation of lighting protection for the reactor building ($26,500); upgrade of the electrical system to 480 volt operation at Spedding Hall ($59,600); and miscellaneous small projects ($10,500).

Notre Dame Radiation Laboratory	$25

This project would provide for building modifications ($20,000) to the laboratory research space and equipment items including benches and fume hoods ($5,000) in the new research addition to the laboratory.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In Millions of dollars]

Fiscal year	Obligations	Costs (fiscal years) 1979	1980	1981	After 1981
Prior year projects		0.202	0.313	0	0
1979 projects	0.270	.015	.255	0	0
1980 projects	.250	0	.150	.100	0
1981 projects	.300	0	0	.200	.100

PROJECT 81-E-308, ENERGY SYSTEMS RESEARCH LABORATORY, OAK RIDGE, TENN.

Fiscal year 1981 authorization	$2,000,000
Total estimated cost	2,000,000

Purpose

The proposed project is for a new multi-story building of approximately 100,000 sq ft to house research laboratories, offices, and service areas. The building will contain high bay areas for multipurpose use, offices, small laboratories for individual research activities, and anciliary support areas. A portion of the roof area will be used for solar energy experimentation. The building will be of reinforced concrete frame construction with shear walls to resist seismic forces. Exterior walls will be precast concerte facing panels with rigid fiberglass insulation and eight inch concrete block backup.

The laboratories will be equipped for temperature and humidity control, special flood loading, clean and sterile rooms, fume hoods, and standard laboratory equipment. The offices will be for a single and multiple occupancy averaging approximately 125 sq ft per occupant. The service areas will include corridors, toilet facilities, stairways, equipment rooms, and freight and passenger elevators.

Facility Description

ORNL has grown in staff and program in recent years, adding to existing office and laboratory problems. Much of the growth has been in nonnuclear programs, so needs for different or special kinds of experimental space have become more acute. ORNL's laboratories are inadequate for its present needs. Much of the space was built during World War II, and few laboratories have been added since the early 1960's. Because of changes in the nature of the programs, the laboratories often do not meet present requirements for height, floor loading, safety, isolation, temperature control, cleanliness, etc.

Office space at ORNL is insufficient for the present staff. Over 800 office users are overcrowded (have 75 sq ft each), and an additional 1,100 are in offices of substandard quality (old and deteriorated, in attics or basements or trailers, noisy, etc.).

In view of the importance of energy development to the nation's domestic and international interests, the Laboratory has undertaken the necessary reorganization and redirection of its staff and facilities to implement programs so that new energy technologies can be developed and utilized as early as possible. Substantial increases in personnel during the past three years have resulted in crowded laboratory conditions and undesirable compromises in some research activities. ORNL has consolidated certain existing operations to provide some space and temporary facilities for these expanded programs. Although these changes have provided temporary relief, the early authorization of this research facility is considered vital to the present conduct of the energy programs.

Project Status

This is a new project. Work will begin in Fiscal year 1981.

Project and Financial Schedules

To be developed.

PROJECT 81-E-309, REHABILITATION, GENERAL PURPOSE PHYSICAL PLANT, ARGONNE, ILL.

Fiscal year 1981 authortization	$10, 100, 000
Total estimated cost	15, 100, 000

Purpose

The structural repairs to the buildings, such as, replacement of roofing, doors, and hardware will rehabilitate the deteriorated structures to an adequate level of acceptability. The project includes work on all of the structure's deteriorated components consisting of the electrical lighting, power, and communication system, the heating, ventilating and air-conditioning systems, and the plumbing systems.

The rehabilitation of the site utilities encompasses repairs to the site distribution systems for electrical power, steam and condensate for heating, process and emergency power generation, domestic and process water, and site sanitary and waste sewer systems to assure their reliability.

Various other subprojects such as repair of transformers and conversion of the water treatment method from lime-soda to ion exchange will achieve compliance with environmental, health and safety requirements.

In addition, the replacement of site perimeter fencing will satisfy security and safeguards requirements. The repair and resurfacing of roads will return their physical condition to acceptable standards of service and highway safety.

Project Description

Buildings:

(1) Replace: Windows and exterior doors in 200 Area; roofing, emergency power, lighting, public address systems, and transformers in various buildings; heating and air conditioning systems or units in Buildings 10, 16, 202, 203, 208, 308 and 310; steamflow meters in various buildings; air compressors in Buildings 1, 2 and 24; air cooled condenser in Building 19; sump pumps and refrigeration equipment in Building 202; and the cooling tower at Building 350.

(2) Repair: Exterior wall, Building 212; maintenance catwalks in various buildings; miscellaneous features in Buildings 617, 817, and 818; cranes and hoists in Building 317; cooling towers and instrumentation at Building 377; heating and cooling systems, Building 600; and plumbing in various buildings.

(3) Install: Air exhaust system, service floor, Building 203; alternate heat pump, Building 362; an ecess pit for a 24 inch raw water valve in Building 377; and emergency power in Buildings 206 and 208.

Utilities:

(1) Replace: Underground power cables and electrical feeder switches, 200 Area; degasifier, high-pressure steam valves and steam and feed water flow meters, Building 108; steam supply line, Building 330; air compressor, Building 129; sewage lift pumps, Building 30; and sand bed dividers, Building 570.

(2) Repair: Transformer throat connections, various location; sanitary sewer system; electrical load center, Building 545; and underground steam distribution system.

(3) Upgrade power distribution system, 300 Area and at Building 546; convert water treatment system from lime/soda to ion exchange, Building 129; and well supply and water distribution systems, sitewide.

Repair and resurface roads and parking areas sitewide; replace security fencing at Sawmill Creek and perimeter fencing at various locations.

Project Status

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	10.1	4.1	4.1
1982	5.0	6.0	6.0
1983		5.0	5.0

PROJECT 81-E-310, TRANSMISSION AND DISTRIBUTION SYSTEMS UPGRADINGING, RICHLAND, WASH.

Fiscal year 1981 authorization	**$6,050,000**
Total estimated cost	**12,000,000**

Purpose

The Hanford Site electrical systems facilities are 35 years old and by the competion date of this project will be approaching a 40-year age. Normal life expectancy for general electrical facilities is 20 years. Many of the system components were not of prime quality when originally installed due to waretime scarcity and the originally short life requirement anticipated. An audit by an independent consulting firm of the Hanford electrical systems has recommended a major portion of the proposed work.

It is imperative that the system be operated and maintained in a highly reliable condition to minimize the possibility of a long power outage. The risk of accident and protection of the environment, personnel, and equipment cannot be continent upon the continued operation of in-plant emergency power systems which cannot sustain operational loads for other than standby requirements. Power outages have occurred four times in 1979 four times in 1978 three times in 1977 and nine times in 1976.

This project will provide the needed upgrading of the Hanford electrical distribution systems, providing reasonable and practical reliability of electrical supplies to reactor, chemical processing, and waste management facilities.

Project description

Upgrading electrical distribution system, reactor, and chemical reprocessing areas

The project will upgrade the reactor, fuel reprocessing, and waste management electrical distribution systems by modification and replacement of the 13.8 and 2.4 kv electrical switchgear, replace deteriorated pole structures and cables, install new supports and line equipment, and compensate for shifts in electrical loads. Emergency and normal circuits serving these facilities will receive physical separation.

Control and metering systems

This part of the project will provide new centralized integrated control of the higher voltage substations and distribution system in the Hanford power systems, installation of annunciators and energy metering equipment with attendant relaying, and a reliable, expandable communications system to accommodate the supervisory control and data acquisition system and automatic metering equipment.

Electrical energy monitoring is either non-existent or obsolete except for recent minor planned improvements. This project will provide instrument transformers and transducers at building locations which will input to the data acquisition system and enables the monitoring of energy consumption and assist in energy conservation activities.

Project status

New start in fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	6.05	1.0	0.5
1982	5.95	11.0	2.0
1983			5.0
1984			4.5

PROJECT 81-E-311, ENERGY SCIENCE AND TECHNOLOGY BUILDING EXPANSION NATIONAL LABORATORY

Fiscal year 1981 authorization	**$12,000,000**
Total estimated costs	**12,000,000**

Purpose

Among the buildings presently occupied, a few are of the permanent post-war type construction, but were originally designed for use other than the functions they now attempt to serve. The majority are temporary buildings of the World War II variety; e.g., wooden frame construction originally designed for a five-year life. Constant maintenance renovations are required to render these buildings usable for the scientific staff and high-cost computer systems that they house. Rather than achieving the great savings that continued reuse of obsolete facilities might imply, the actual expenses are considerable, and, since buildings are normally used where they are located, diffusion of effort rather than concentration ensues.

The expansion of the existing building is designed to provide offices, work rooms, laboratories, libraries, computation areas, and other ancillary space for approximately 190 scientists, engineers, and other support personnel. Occupancy of the building will not add any incremental programmatic operating cost. However, it will provide for the centralization of most ?????

Facility Description

As presently conceived, this project will provide a 73,000 gross square foot addition to the Energy Science and Technology Building, consisting of a one-story chemistry laboratory wing, a one-story high bay laboratory, and a three-story wing to house research offices and miscellaneous support operations.

Improvements to the site will include new parking and service areas, lighting, and walks. The existing entrance drive and parking area will be modified and an existing road relocated to provide space for extending the chemistry laboratory wing.

The laboratories will be equipped with auxiliary or make-up air type fume hoods, standard benches, cabinets, and standard utilities including water, compressed air, power, and complete environmental systems with individual automatic controls, and fire protection system.

The high bay areas will also be equipped with bridge cranes.

Construction will match the original building; e.g., steel frame, masonry and insulated panel walls, concrete floor slabs, and built-up roof. Utilities will be extended from existing plant services.

Project Status

New start in fiscal year 1981. This project is one to be reviewed by the Department to assure that the addition will be constructed at minimum cost consistent with needs.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	12.0	2.5	2.5
1982		9.5	9.5

PROJECT 81-E-312, ENVIRONMENTAL AND ENERGY TECHNOLOGY FACILITY, RICHLAND, WASH.

Fiscal year 1981 authorization	$4,000,000
Total estimated cost	18,000,000

Purpose

Some of the technologies will be in the pilot-scale and demonstration plant phase of development when the EETF becomes available in the early 1980s. For proper commercialization of the processes, demonstration projects are expected to involve industry and/or local government efforts at sites other than the laboratory. In addition, some pilot-scale work will be conducted away from the laboratory. However, in such cases, our experience indicates that there will be an accompanying need for laboratory-scale support and process experimentation. For example, long experience in process technology support of Hanford plant operations shows that it is imperative to have analytical, materials, and process development laboratories supporting demonstration plants in order to achieve target performance and to develop the technology for next-generation plants. This is particularly important in the current situation, when technology development is accelerating rapidly to meet the urgent need for energy.

Facility description

This project will provide a laboratory-office building to accommodate the environmental and energy-related research and development activities described in the PNL Institutional Plan. As currently conceived, it will include: (1) 49,000 square foot laboratory element; (2) an adjoining 10,800 square foot high bay annex; (3) 50,000 square foot office wing; and (4) supporting utilities and site work. It is proposed to construct the new facility in the southern portion of the 300 Area.

The 49,000 square foot laboratory element will contain approximately 26,400 square feet of laboratories (forty-four 20′×30′ laboratories), 5,400 square feet of offices, 5,200 square feet of shops and other support facilities, and 12,000 square feet of equipment rooms and other building service areas. The laboratories will be of two general types: (1) 8 will be environmentally controlled to permit work on toxic/carcinogenic materials; (2) 36 will be general purpose laboratories not intended for hazardous materials work. Up to 14 of the general purpose laboratories will be designed to permit conversion to controlled access laboratories later if programmatic needs so dictate.

The 10,800 square foot high bay will be a 60′×180′ enclosure 40 feet high. A 20 ton bridge crane with a 25′ hook height will span the 60′ width.

The 52,000 square foot office wing will provide office space for about 225 people. The combined facilities provided by this project will accommodate a research and development staff of about 340 scientists, engineers, and supporting personnel working on DOE research and development activities in the conservation, solar, geothermal, basic sciences, fossil and environmental areas.

In areas of the building where greater than environmental qualities of toxic-carcinogenic materials are handled, building air will pass through two banks of high efficiency particulate air (HEPA) filters in series and a charcoal filter before exhaustion to the environs by multiple exhaust fans. Ventilation and exhaust systems will be equipped with automatic and manual dampers to maintain proper air flow balance. Critical exhaust streams will be monitored.

Laboratories, shops and other support areas will be equipped with all necessary furniture and stationary equipment. The laboratories will be supplied with hot and cold water, compressed air, vacuum, propane gas, and 115 volt and 208 volt electricity. A centralized room air sampling system will also be provided for the controlled access laboratorites.

Project status

New start in Fiscal Year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	18	13.7	13.7
1982		4.3	4.3
1983			

PROJECT 81–E–313, CENTRAL ENERGY CONSERVATION FACILITY, BROOKHAVEN NATIONAL LABORATORY

Fiscal year 1981 authorization	$7,100,000
Total estimated cost	9,100,000

Purpose

This project will serve three basic purposes: conservation of natural resources; improved efficiency of plant operations; and reduced future maintenance and capital funding requirements.

The research facilities at the Laboratory are presently served by individual units and systems totaling approximately 17,000 tons of refrigeration and 10,450 SCFM compressed air capacity, and consisting of over 35 refrigeration units and 250 self-contained compressed air systems. A number of these units are over 20 years old, in obsolete or spent condition, and must be replaced in the near future.

The proposed central plant will initially allow the retirement of outmoded equipment serving six major complexes and a number of smaller systems throughout the site and ultimately serve the entire site as additional existing equipment becomes obsolete, or maintenance and repair costs approach exceeding the cost of conversion to the central plant system.

Facility Description

As presently conceived, this projct will provide a central chilled water and compressed air plant and distribution systems to serve six major research complexes. The plant will be constructed adjacent to the central steam plant and will consist of two buildings of approximately 6,140 gross square feet total and a 5,100 ton cooling tower. One building with a 20 foot eave height will house the major refrigeration equipment; three 1,700 ton chillers, a 1,500 standard cubic feet per minute (SCFM) air compressor and ancillary pumps, control systems, piping, and switchgear. The second building, a condenser water pump house with a 13 foot eave height, will house two vertical condenser water pumps and ancillary equipment.

Both buildings will be steel frame, slab-on grade construction, with insulated metal panels or masonry walls and built-up roof on metal deck.

Utilities will include the installation of 16,000 feet of underground chilled water piping, and 8,000 feet of compressed air transport piping from the new plant to the research complexes; a 500 KVA transformer substation with switchgear at 13.8 KV, 2.4 KV and 480 volts; and relocation of other utility systems to clear interferences.

The present macadam service road will be extended approximately 50 feet to serve the new buildings.

Project Status

New start in Fiscal Year 1981.

PROSECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	9.1	5.9	5.9
1982	0	3.2	3.2
1983	0	0	0

PROJECT 81–E–314, ENERGY UTILIZATION IMPROVEMENTS, BROOKHAVEN NATIONAL LABORATORY

Fiscal year 1981 authorization	$2,000,000
Total estimated cost	2,000,000

Purpose

This project will replace a 30-year old low-pressure steam distribution system and 15 independent, inefficient and uneconomical heating plants with a new high and low-pressure steam distribution system supplied by the Central Steam Plant. The project will conserve approximately 46,000 gallons of fuel each year. The existing low pressure steam distribution piping to the seven central site buildings is essentially a conduit system consisting of magnesia insulated steam and condensate lines supported inside a corrugated metal casing.

Over the years, numerous fractures have developed in the underground casing allowing water to enter the conduit system, and resulting in dissolving both the insulation and the concrete pipe supports and corroding the steel piping. Not only has this critically impaired the heating system, but steam and condensate leaks have caused the ardized a 13.8 volt electrical service, fire alarm, and main telephone failure of an essential 2400 volt electrical service and seriously jeop- trunk lines. These leaks have resulted in increased make-up water (approximately 6000 gallons per day) at the Central Steam Facility that must be heated and chemically treated. Continuing repairs to this underground steam transport piping and critical ancillary services has proved to be economically and operationally counter-productive toward assuring continuing of scientific and support operations.

Facility Description

This project consists of the installation of approximately 13,600 feet high and low pressure underground steam and condensate mains, and 6 steam pressure reducing stations, to provide new heating services from the central steam plant to 22 buildings located in the central, eastern, and southern sectors of the Laboratory site.

All of the steam and condensate lines to be installed in the proposed project will be in a conduit system with both lines insulated to reduce BTU losses. The total designed steam requirement for this project is well within the nominal capacity of the existing Central Steam Facility.

Project Status

New project starting in Fiscal Year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars,

Fiscal year	Authorizations	Appropriations	Obligations
1981	2	2	2
1982	0	0	0
1983	0	0	0

PROJECT 81-E-315, CENTRALIZED COGENERATION W/CHILLED AND HOT WATER DISTRIBUTION, ARGONNE, ILL.

Fiscal year 1981 authorization	$7,400,000
Total estimated cost	7,400,000

Purpose

This project is required to replace obsolete, inefficient and uneconomic refrigeration machinery and cooling towers now scattered around the site. Approximately 5400 tons of refrigeration will need to be replaced over the next 4 years beginning with 1000 tons in 1982.

Due to energy conservation measures, most of the separate building systems are now oversized. With additional energy conservation retrofits this inefficient mode of operation will increase. Incorporation of a central chill water system will permit base loading of a major part of the cooling demand. Also, the chill water loop will permit future interconnection of existing excess capacity equipment negating the need for unnecessary capital additions in future buildings. Also, the chilled water loop will be used in the water to provide heat to the buildings it serves thus eliminating the use of preheat coils and the need to replace them. The preheat coils are fed by the steam loop.

The cogeneration approach allows the generation of electricity which will offset that which is now purchased from offsite at a significant cost savings.

Facility Desription

The proposed project provides a centralized cogeneration and chilled and hot water distribution system for more effective utilization of the existing steam plant with resulting conservation of energy and scarce fuel resources. Superheat capability will be added to the existing Boiler #5, originally designed for such capability but not incorporated when the installation was made in 1963. 135,000 1b/hr. of 200 psig. 700° F. steam will be supplied to a new non-condensing, single extraction steam turbine driven generator nominally rated at 2.5 MWe with capability for delivering a maximum of 4.0 MWe with extraction. Electricity generated at 13.8 KV will be transmitted by a new overhead line to the existing step-down transformers located at Building 544 for distribution over the existing site utility system. For summer cooling, 125 psig steam from the generator turbine will supply three new 1,000 ton single stage absorption refrifieration units. These absorption units will supply the cooling water for a new loop serving ten major buildings within the Laboratory inner circle. Loop construction will utilize fiberglass reinforced pipe, buried and insulated, and will parallel the existing buried steam loop and building branch connections. The absorption refrigeration unit condensers will be cooled by a new forced draft cooling tower adjacent to the cogeneration plant.

During the winter, the absorption units will be operated in a heat pump mode to generate hot water (135°) which will be fed through the "chilled" water loop for air preheat in the existing building HVAC system coils.

Steam in excess of that needed for chilled water and hot water will be extracted from the turbine at 125 psig for distribution in the existing Laboratory steam loop. As a result of the planned inhouse energy management retrofit program and the central thermal water loop. total Laboratory steam requirements are reduced to enable the existing distribution system to handle the increased volume of lower pressure steam.

Project Status

New start in Fiscal Year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	7.4	2.0	2.0
1982	0	5.4	5.4
1983	0	0	0

PROJECT 81–E–316, "BOILER NO. 3" REPLACEMENT, BROOKHAVEN NATIONAL LABORATORY

Fiscal year 1981 authorization	$3,000,000
Total estimated cost	$3,000,000

Purpose

This project will achieve three objectives: enhance the ability of the Laboratory to comply with the National Energy Act of 1978 and Executive Order 12003, Relating to Energy Policy and Conservation, and implementing Executive Department guidance; provide adequate capacity to ensure full plant operations during winter months; and allow retirement of an outmoded, inefficient, 24-year old boiler, while simultaneously complying with Federal and state (6 N.Y. CRR, Part 277(c)) particulate emission standards.

Technical consultants enlisted to conduct the site energy survey have advised that the condition and age of boiler No. 3 is not adaptable to modern energy conservation measures. They recommended boiler No. 3 be replaced with an up-to-date, energy efficient and reliable boiler of a capacity (125,000 #/hr.) that can provide the most beneficial loading operation of the Central Steam Facility for reducing raw energy input to the facility.

The proposed new boiler will be designed to meet particulate emission controls; ensure continuity of plant operations; and reduce consumption of a valuable energy resource.

The proposed new boiler will burn a non-critical form of fuel, namely an alternate liquid fuel (ALF) as its source of raw energy input. The ALF used at Brookhaven National Laboratory is formulated by selectively blending feedstocks of recycled or previously used semi-miscible alcohols, mineral spirits, solvents and other combustible liquids to provide a homogeneous fuel of predictable BTU content, viscosity and flash point.

Facility Description

This project provides for a new boiler and the modification of the Central Steam Facility to house it. The boiler will have a capacity of 125,000 pounds per hour at 125 pressure per square inch gauge (psig). The new unit will be equipped with an air heater, soot blowers, force draft fan with electric and steam turbine drives, feed water regulator, steam atomizing—high efficiency and clean firing duel fuel burner(s) for burning 100% Alternate Liquid Fuel (ALF), virgin No. 6 fuel oil, and various combinations of ALF and virgin fuel oil. The boiler will be connected to associated support systems, both new and modified, including: combustion air, fuel oil, feed water and deaeration, chemical treatment, steam, electrical, compressed air, and drainage systems.

The required building modifications to the Central Steam Facility are for accommodating the new boiler configuration and auxiliary equipment arrangement. These building alterations relate essentially to reinforcing the structural steel members, raising a section of the roof line and the removal and replacement of the building sidewall to facilitate rigging-in the new boiler.

Project Status

New start in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	3	3	3
1982	0	0	0
1983	0	0	0
1984	0	0	0

PROJECT 81–E–317, INEL ROOF REPLACEMENT, IDAHO NATIONAL ENGINEERING LABORATORY

Fiscal year authorization	$4,300,000
Total estimated cost	4,300,000

Purpose

In compliance with the objective to restore deteriorated structures to an acceptable condition, the roofs of severa buildings at INEL must be partially or completely replaced.

The buildings outlined have been identified through surveys and maintenance records and are considered to have the most deteriorated roofs which can be corrected only by replacement. It should be noted that a continuing study of requirements may result in some of the subprojects being changed in scope, other projects being added, or necessary postponements of some now listed, all depending on conditions or situations not presently apparent.

The CFA-664 roof has been identified for replacement and houses the service station facilities which support the INEL Automobile Transportation Services. The 27-year-old flat roof is severely deteriorated and many recurring leaks have developed. The rigid insulation is saturated and ineffective, thus wasting fuel. The built-up asphalt surfacing is severely blisterd and cracked and the many attmpts in recent years to patch the roof have been largely unsuccessful.

Th ages of the TRA roof systems range up to 28 years with the majority in excess of 25 years old. The deterioration of the roof membrane from age plus the application of asphalt emulsion for leak repair makes it impossible to restore the impermeable quality of the roof system. The roof insulation has become saturated from roof leakage resulting in thermally inefficient roof systems, numerous repairs have been made to many of the roofs but they are too old to hold them. The roof leakage is also a constant threat to the essential mechanical and electrical equipment described above and a major leak could occur and result in the loss of the essential services provided. The loss of any one of these services could result in a major programmatic impact. As an example, losses from unscheduled shutdown of the Advanced Test Aeactor (ATR) are approximately $2,000 per hour.

Most of these TAN roofs are 26 years old. Loss of thermal energy, saturated insulation, leakage and settled roofs which cannot drain have reached serious and costly proportions. It is no longer possible to repair these roofs satisfactorily to maintain them in a condition which will give adequate protection to the equipment and personnel performing essential services in the building.

Facility Description

The project consists of partial or complete roof replacement on several buildings at the INEL. Areas in which there are buildings requiring roof replacement at this time are as follows: (a) Central facilities area (CFA); (b) Test reactor area (TRA); and (c) Test area north (TAN).

Project Status

Project starting in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	5.3	3.3	3.3
1982	0	2.0	2.0
1983	0	0	0

PROJECT 81-5-318, UPGRADE PRIMARY SUBSTATION, OAK RIDGE NATIONAL LABORATORY, TENN.

Fiscal year 1981 authorization	$3,500,000
Total estimated cost	3,500,000

Purpose

The purpose of the project is to upgrade the substation to improve the Oak Ridge Area power system to provide the necessary additional transformer capacity to meet future load growth; to maintain a high degree of service continuity; and to improve the flexibility, reliability, and safety of the substation.

The existing primary substation capacity consists of one 35-MVA, installed in 1943, and one 40-MVA transformer, installed in 1961, with provisions for operating in paralled. Operating policy is to load the primary substation to the point where the substation, with a single transformer outage, can continue to carry the load. Currently, the peak seasonal demand load is 43.3-MVA, which exceeds the nameplate limit for the larger of the existing transformers. By 1982, there will be an additional load of 19.8-MVA as a result of bringing into operation new facilities such as the Holifield Heavy Ion Facility and gas to coal conversion of the steam plant. Under these load demands, an outage in one of the two existing transformers would require a shutdown of heavy power users as HFIR, ORIC, ORELA, ORR, HHIF to reduce power consumption by 35 to 45%. The additional 40–MVA ransformer is needed to ensure continuity of ORNL operations in the ture.

acility Description

The project will add 40–MVA of electrical capacity to an existing primary 161/13.8–kV Oak Ridge National Laboratory (ORNL) substation. The project will provide three new 161–kV oil circuit breakers, four additional 161–kV disconnect switches, one additional 161/13.8–kV transformer, two additional 13.8–kV oil circuit breakers, four additional 13.8–kV disconnect switches, and the necessary control and metering circuits. Security fencing will be added as protection for the new and existing equipment.

Project Status

Project to begin Fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations
1981	3.5	3.5
1982	0	0
1983	0	0

PROJECT 81–E–319, INSTALLATION OF COAL-FIRED ATMOSPHERIC FLUIDIZED BED BOILER, ARGONNE NATIONAL LABORATORY, ILL.

Fiscal year 1981 authorization	$7, 100, 000
Total estimated cost	7, 100, 000

Purpose

The purpose of this project is to replace boiler No. 1 which has been in continuous service for nearly 30 years and is approaching the end of its useful economic life. By replacing the gas/oil fired boiler No. 1 with a coal burning boiler the consumption of natural gas and fuel oil at ANL will be greatly reduced, thus enhancing the ability of the Laboratory to comply with the National Energy Act of 1978 and Executive Order 12003, Relating to Energy Policy and Conservation, and implementing Executive Department guidance. A coal-fired fluidized bed boiler burning high sulfur coal readily available in this geographic area will be able to generate steam more economically than either an oil-fired or gas-fired boiler.

Facility description

This project provides for the replacement of an existing old gas-and-oil-fired boiler with a coal-fired atmospheric fluidized-bed boiler. The new boiler will have a rated output of 100,000 lbs./hr. of saturated steam at 200 psig and will be installed in the same physical location as the old 85,000 lbs./hr. boiler. A particulate exhaust stack gas cleanup system will be installed to meet emissions standards.

Project status

Begins in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	7.1	7.1	7.1
1982	0	0	0
1983	0	0	0

PROJECT 81-E-321, SITE UTILITIES PROJECT, LAWRENCE LIVERMORE LABORATORY, CALIF.

Fiscal year 1981 authorization	$7,900,000
Total estimated cost	7,900,000

Purpose

A review of the demand requirements of LLL programmatic activities has indicated that a ten-megawatt expansion of the Central LCW Station is required to accommodate projects approved and planned through FY 1981. LCW is a high-quality water circulated through the site in a closed-loop system and is used for cooling experimental apparatus, laboratory equipment, shop equipment, etc., and as a condenser cooling medium for refrigeration and air-conditioning equipment.

Replacement of 2,500 feet of undersized LCW mains on Avenue B with larger mains will provide greater LCW transfer capacity between the Northwest and Central systems. This will allow loads to be balanced between stations. The installation of a second air compressor in the Northwest mechanical utility station is needed to satisfy expanding laboratory demands for compressed air for major projects approved and planned through FY 1981. Heavy compressed air demands will be experienced upon completion of NOVA and MTFT projects (major FY 1978 experimental facilities) and planned FY 1981 projects.

The proposed parking lot will replace parking areas on old air field paving, much of which will be utilized by the southeastern end of the new roadway. Also, additional parking space will be required for personnel in the growing MFE program, as well as for stores and facilities operations personnel.

Facility Description

This project provides three major additions to the Livermore Site utility systems, as described below.

The central low conductivity water (LCW) system will be expanded by a 10 megawatt (MW) addition to the existing 37 MW Central Station at the Utilities Control Building. This subproject will consist of a 10 MW cooling tower, three heat exchangers, two cooling tower pumps, two LCW pumps, and a motor control center. Major modifications and additions to system instrumentation and controls will be made to improve operating efficiency and conserve energy. Annual energy and cost savings are estimated at 2.2 million kilowatt hours (KWH) and $150,000 respectively. Two heat exchangers and one pump will be replaced with larger units and selected headers replaced to improve thermal and hydraulic efficiency. Approximately 2,500 feet of undersized LCW supply and return mains on Avenue B will be replaced with 16-inch lines. This will provide greater transfer capacity between the Central and the Northwest Stations.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	7,900	700	700
1982	0	7,200	7,200
1983	0	0	0

PROJECT 81–E–322, SCOVILLE SUBSTATION DISTRIBUTION SYSTEM UPGRADE, IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO

Fiscal year 1981 authorization	$1,000,000
Total estimated cost	1,000,000

Purpose

The purpose of this project is to replace an unreliable utility system, an old and underrated 138–44–12.5 kv electrical distribution system. This system provides backup power to CFA and the Radioactive Waste Management Complex (RWMC) area. It also supplies power to the Experimental Breeder Reactor I historical site and the 12.5 kv construction line. The existing system is limited to 2 mva by the 44–12.5 kv transformer bank's power rating. During January of 1979 the peak load on this 12.5 kv system was 2.4 mw. Power demand exceeded 2 mw every workday during the month. Three projects planned for the CFA in FY 1979 will add 1.3 mw to the current electrical demand. They are: an addition to CF–688—0.7 mw, a new construction management building 0 0.2 mw, and a geothermal well—0.4 mw. If the existing system is not replaced before that time, many of the electrical loads will not have a backup power supply. If the normal supply transformer failed, these loads could not be accommodated for the one year estimated time of procurement for the replacement transformer.

Facility Descrition

This project replaces the existing 138–44–12.5 kv electrical distribution system at the Scoville Substation, which is located in the Central Facilities Area (CFA). The project provides for the design and construction of a new 138–12.5 kv distribution system capable of parallel operation with an existing 7.5/10.5 mva power transformer (8T1–2).

The existing 7.5 mva 138–44 kv power transformer (8T1–1), four 667 kva 44–7.2 kv transformers, switches, buswork and structures comprising the existing 44 kv system would be removed. The new system would consist of a 7.5/10.5 mva, 138–12.5 kv, three phase, 60 cycle power transformer with a 2.4 kv tertiary winding and associated equipment foundations, breakers, switches, protective relays and controls. An existing capacitor bank will be rewired for 12.5 kv operation and connected to the new system using an existing oil circuit breaker (4B1–6) for power factor correction.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULES

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	1,000	1,000	1,000
1982	0	0	0

PROJECT 81–E–323, FIRE SAFETY IMPROVEMENTS, ARGONNE NATIONAL LABORATORY, ILL.

Fiscal year 1981 authorization	$4,100,000
Total estimated cost	4,100,000

Purpose

This project is required to upgrade the fire protection systems, reduce fire and smoke hazards, and generally improve the Laboratory's capability to protect life and property. The work proposed is necessary to meet current fire codes and to implement recommendations of national fire insurance consultants to meet the Departments Improved Risk Criteria. The improvements will be based upon the potential dollar loss and/or current programmatic importance at the time funding is provided. It should be noted that a continuing study of requirements may result in some of the projects being changed in scope, other projects being added, or necessary postponement of some listed, all depending on conditions or situations not presently apparent.

(*a*) Water Supplies: Improve the reliability, pressure and capacity of the Argonne water supply system by extending the watermain into the 800 Area to form a loop; replacing the existing 6″ mains with 10″ mains serving the 200, 300 and 800 Areas; installing new 6″ connections to serve Buildings 203, 206, 208, 211, 212, 223 and 310; installing at ANL-West emergency power for water pumps, extending the water supply loop, and the supply line to serve the MFEF/N and the SCCF; and at both sites by appropriate valving and hydrants.

(*b*) Automatic Sprinkler Protection: Achieve an improved risk position by installing sprinkler systems in Argonne high risk Buildings 5, 6, 200, 203, 205, 208, 211, 212, 223, 310, 314, 316, 360, 361, 362, 364, 376, and 391, and expanding existing systems in Buildings 2, 10, 11, 16, 200, 108, 213, 330, 335, 363, 366, 368, 369, 370, 374, 375, 378, 379, 382, 801, and 817; and in the Laboratory office building and the ZPPR support wing at ANL-West.

(*c*) Fire Suppression Systems: Protect equipment of such nature that its loss would have serious impact, delaying critical or high priority operations, by installing foam or inert gas suppressant systems in special hapard areas in ANL Buildings 108, 212, 314, 360 and 364, and in the experiment control room adjacent t Building 375; and in the Fuel Assemblyand Storage Building at ANL-West.

(*d*) Fire Detection Systems: Improve life safety protection and protect high value equipment at Argonne by installing automatic heat or smoke detection systems in Buildings 2, 10, 205, 223, and 365; and at ANL-West in the Fuel Assembly and Storage Building, trailers at the Treat reactor and control room, and the Dangerous Materials Storage Building.

(*e*) Architectural and Structural Modifications: Improve life safety protection and reduce fire spread potentia at Argonne through properly enclosing stairwells, replacing combustible materials with non-combustibles, relocating high risk equipment from a combustible building to one constructed of non-combustibles, and installing automatic fire doors and dampers. Buildings involved include: 14, 24, 200, 202, 208, 221, 364, 365, and 801. Also included is the removal of the wood-cooling tower adjacent to Building 331; and at ANL-West through sealing penetrations and fireproofing structural steel in the EBR-II powerhouse.

Facility Description

This project consists of installing new and/or modifying selected facilities at the two laboratories to meet "improved risk" fire protection criteria. The fire safety improvements consist of five general groupings: (1) water supplies, (2) automatic fire protection, (3) fire suppression systems, (4) fire detection systems and (5) construction modifications for fire protection.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	4,100	4,100	4,100
1982	0	0	0
1983	0	0	0

PROJECT 81-E-324, FIRE SAFETY AND PROTECTION IMPROVEMENTS, IDAHO NATIONAL ENGINEERING LABORATOFY, IDAHO

Fiscal year 1981 authorization	$3,400,000
Total estimated cost	4,400,000

Purpose

This project is proposed to achieve compliance with DOE safety regulations. In addition, it will comply with the recommendations submitted by the Factory Mutual Engineering Association and to bring various INEL facilities up to "improved risk" Fire Protection Standards. One of the primary objectives is to provide a level of fire protection to minimize the $1,000,000 or greater loss potentials. The Factory Mutual System's approach to private industry is to evaluate and recommend fire protection features on a practical and economic basis for much lower loss potentials in order to qualify as an "improved risk." For this reason, recommendations are included for deficiencies that could result in loss potentials in the $100,000 to $1,000,000 range, particularly if there is the potential for program interruption.

The desired level of fire protection to be furnished with this project will prevent: (a) violating the normal containment provided for restricting the spread of radioactive or other hazardous materials, (b) inflicting a fire loss in excess of $1,000,000 (including contamination cleanup), (c) introducing new risks during fire suppression significantly increasing preexisting risks of inadvertent criticality, (d) significantly increasing the release of radioactive or other hazardous materials to the external environment.

A commitment has been made to upgrade all facilities to "improved risk" criteria. The initial goal was for funding and completion of the projects within three years of the fire protection survey. This goal must now be delayed due to lack of prior funding. If this project is funded at this time it will still be 10 years from the survey until completion of these projects. Deferring or deleting the project increases the probability of sustaining a large fire loss in a critical facility.

Facility Description

The project consists of installing new fire protection systems or modifying existing systems in Idaho National Engineering Laboratory (INEL) facilities to comply with the recommendations submitted by the Factory Mutual Fire Protection survey team in their report dated October 1973, and those items submitted in their 1978 Resurvey Draft Report. These fire protection improvements are justified based upon current values, programmatic importance and hazards present either in construction or occupancy.

This project consists of the following: installing a number of new fire sprinkler systems and in some cases upgrading existing systems; replacing approximately 4,700 feet of fire water main including valves and hydrants; replacing the present obsolete alarm and monitoring system in some areas; providing one 300,000 gallon fire pump suction storage tank and modifying other storage tanks to prevent freezing; installing several HALON 1301 fire extinguishing systems in electronic areas; expanding an existing fire station to house emergency equipment; upgrading the drill field to accommodate specialized fire fighting training for INEL risks; and the provision of a 1,000 gpm, diesel driven fire pump.

Project Status

To begin in fiscal year 1981.

PROJECT AND FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	4, 400	3, 400	3, 400
1982	0	1, 000	1, 000
1983	0	0	0

PROJECT 81-H-08, ENERGY TECHNOLOGY BUILDING, SANDIA LABORATORIES, ALBUQUERQUE, N. MEX.

Fiscal year 1981 authorization	$1,000,000
Total estimated cost	Undetermined

Purpose

The expanding role of Sandia Laboratories into civilian energy supply development has led to a need for additional laboratory and office space. Current working conditions are unsatisfactory to support adequate job performance.

Facility Description

This project will be sized to meet the requirements for Sandia's programs. The initial authorization is to enable preliminary engineering (Title I) to be performed. It is expected that the project will be similar to the Systems Research and Development Building and the Nuclear Safeguards Security Office and Light Laboratory Building.

Project Status

This is a new start in fiscal year 1981.

PROJECT 81-E-218, TEVATRON, PHASE I, FERMI NATIONAL ACCELERATOR LABORATORY

Fiscal year 1981 authorization	$27,000,000
Total estimated cost	39,500,000

Purpose

When protons and antiprotons are stored in the superconducting ring and brought into collision, the energy available for particle production would be 2000 GeV. This is about 65 times greater than the 31 GeV of center of mass energy which is available now at Fermilab when 500-GeV protons strike a fixed target.

The proposed energy is expected to be sufficiently high to produce the conjectured, but as yet unobserved, intermediate vector mesons. This family of particles is presumed to be the carrier of the weak forces, responsible for nuclear beta decay. A phenomenological description of these forces was first made by Enrico Fermi, after whom Fermilab was named, nearly fifty years ago. Attempts to put this description on a more fundamental basis led to the postulation of the existence of these particles.

The data from experiments done at Fermilab and at other high energy accelerators has shown that the proton behaves as though it were made up of constituent particles called quarks. The energies available from pp collisions at the Tevatron will further enhance our understanding of the quark model and may even produce free quarks.

Project Description

A second approximately 200-MeV ring will be used for final cooling of the antiproton beam after it emerges from the pre-cooler and for accumulating antiprotons from successive cycles of targeting and precooling in the first ring. The cooling at this stage of the collection scheme is required not only to reduce the momentum spread of the particles but also to stack the particles produced in each cycle. The project will provide for the construction of the pre-cooler, its enclosure, and the conversion of the R&D electron-cooling experiment to an operating device.

To operate the superconducting Energy Saver ring near the full energy of 1 TeV requires additional satellite refrigerators or their equivalent. The additional refrigeration is needed because superconductors near full field will make the transition from the superconducting to normal state with only small amounts of energy deposited in them. Thus, extra cooling will help prevent quenches of the superconducting ring. To accelerate and store protons in one direction and antiprotons in the opposite direction and then to collide them requires additional rf cavities and other special devices.

The conventional construction to house high energy physics experiments will be an integral part of the Main Ring tunnel. Important considerations that will be incorporated into the design are: the rapid and efficient introduction of large detectors into the beam and a detector assembly area. The part of the construction which requires the Main Ring to be shut down will be done concurrently with the installation of the Energy Saver thus eliminating the need for an additional extended shutdown for them.

Project Status

This project is a new start in fiscal year 1981.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	39, 500	2, 000	2, 000
1982	0	25, 000	25, 000
1983	0	12, 500	12, 500

PROJECT 81–E–219, ACCELERATOR IMPROVEMENTS AND MODIFICATIONS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$6, 000, 000
Total estimated cost	6, 000, 000

Purpose

Accelerator improvements are necessary on an annual basis to improve the efficiency, reliability and scientific effectiveness of the accelerator facilities. For an annual investment less than 1% of the total capital worth of the facilities, substantial benefits are achieved. Specifically the projects requested for FY 1981 will increase productivity by providing greater flexibility for experimental setups during operation; by increasing reliability of machine operations; by capitalizing upon the ability to operate at increased performance levels; by increasing the serviceability and decreasing machine downtime; and by improving data gathering capabilities of the complete accelerator system.

The improvements at Brookhaven National Laboratory will improve the overall performance of the AGS and improve the overall safety of accelerator operations by reducing radiation levels.

At Fermi National Accelerator Laboratory, accelerator and related improvements are designed to: increase reliability and intensity of accelerators; improve research capabilities of the machine through upgrading beam efficiency; enhance the range of experimental energies; and upgrade the beam lines to both save energy and permit a broader range of experiments.

Finally, at Stanford Linear Accelerator Center, improvements will effectively improve the safety of accelerator operations and will increase the machine's productivity by providing greater flexibility for experimental setups during operation.

Project Description

Brookhaven National Laboratory	$1,400

This project provides for modifications and improvements to the synchrotron and associated facilities. Included are modifications to reduce radiation levels around the main magnet ring, semi-permanently installed shielding, improvements to the vacuum system and modifications to the central control room.

Fermi National Accelerator Laboratory	$3,500

This project includes: accelerator additions and modifications dealing with extraction; beam short and injection; switchyard improvements; experimental facilities additions and modifications such as the relocation of N3/5 Beam; neutrino line bypass beam dump and radiation hardened beam splitters.

Stanford Linear Accelerator Center	$1,100

This project includes: fabrication, test and installation of additional wiggler magnets in one of the insertion regions of the PEP storage ring; replacement of the three master oscillators with new frequency synthesizer-type network; drive system improvements related to fast phase switching; new instrumentation in the accelerator, the beam switchyard and the experimental beam lines; a beam interlock system; a new LINAC analog system; special beam position monitors; and high sensitivity beam position and pulse-to-pulse intensity monitors.

Project Status

This project is a new start in fiscal year 1981.

PROJECT 81-E-220, GENERAL PLANT PROJECTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$5,000,000
Total estimated cost	5,000,000

Purpose

This project is required to provide for minor new construction and other capital alterations and additions, for buildings and utility systems. Where applicable, the request also includes the costs of installed capital equipment integral to a subproject. Funding of this type is essential for maintaining the productivity and usefulness of DOE-owned facilities. Since it is difficult to detail this type of project in advance, a continuing evaluation of requirements and priorities may be expected to result in additions, deletions, and changes to the currently planned subprojects. In general, the estimated funding for each location is preliminary in nature, and is intended primarily to indicate the relative magnitude of the requirements. No significant R&D

program is anticipated as a prerequisite for design and construction of the subprojects under consideration.

Brookhaven National Laboratory -- **$2,600**

Project Descriptions

Requirements include: a staging area for accelerator use ($300,000); building additions for the accelerator complex ($400,000); ductbank expansion ($150,000); laboratory renovations ($300,000); an environmental safety assembly building ($300,000); building improvements to chemistry, applied mathematics and light source facilities ($400,000); water system improvements ($350,000); extension of steam service ($200,000); and crane installation and vent system improvements ($200,000).

Fermi National Accelerator Laboratory ---------------------------------- **$1,400**

Requirements include: an east addition to the transfer gallery ($250,000); main ring utility improvements ($100,000); experimental cooling, drainage and road work ($200,000); a building expansion for the experimental area helium recovery system ($200,000); a neutrino laboratory addition ($250,000); utility, fire monitoring and road improvements (--------).

Stanford Linear Accelerator Center --------------------------------------- **$1,000**

Requirements include: building expansions ($150,000); power additions ($150,000); a bubble chamber building extension ($200,000); additional floor space for the central computer facility ($200,000); a cooling tower ($200,000); and power additions ($100,000).

Project Status

This is a new start in fiscal year 1981.

PROJECT 79–9–B, ENERGY SAVER, FERMI NATIONAL ACCELERATOR LABORATORY

Fiscal year 1981 authorization	**$19,600,000**
Total estimated cost	**46,600,000**

Purpose

An energy increase from 400 GeV, the current limit due to the cost of electric power, to 500 GeV is important. It substantially increases the fluxes secondary beams as well as their maximum energy. Furthermore, the cost saving that will be realized from the operation of the Energy Saver, stemming from reduced power consumption, will be a substantial factor in the effective operation of Fermilab. The release of several million dollars otherwise required for electrical energy will be an important factor in providing for a more vigorous research program as well as contributing to the nation's energy conservation efforts. These important advantages for Fermilab have added significance due to the competition coming from the new, strongly equipped 400–GeV laboratory at CERN.

Project Description

This project will provide a ring of superconducting magnet's and the ancillary systems required so that the ring can operate as a fixed target proton accelerator capable of delivering 500 GeV primary protons to three external experimental areas and protons at about 800 GeV to an internal target.

The following equipment will be included:

Refrigeration System

Satellite refrigerators will be used in conjunction with the Central Helium Facility to maintain the superconducting magnets at liquid helium temperature. The refrigeration system consists of compressors, cold boxes, expansion engines, liquid helium distribution and transfer lines and appropriate controls and instrumentation.

Power Supplies

Main Ring power supplies will be modified to operate with the Energy Saver in order to: a) supply the magnet excitation energy at a sufficiently high voltage to excite the Energy Saver ring, and b) to supply sufficient inverter capacity to return the stored magnet energy from the magnets to the incoming power lines. These power supplies will be operated from the upgraded Main Ring control system in order to adapt to the ramp requirements of the Energy Saver while continuing to serve the Main Ring needs.

RF

Accelerating voltage capabilities will be provided for the Energy Saver by a separate set of accelerating cavities. The equipment will be similar to that used in the Main Ring. This project will provide frequency controls, tuners, phase controls, protective circuitry, vacuum pumps, and other equipment required to complete the systems.

Extraction

An extraction system consisting of electrostatic septa, magnetic septa, kickers, superconducting bending magnets and other extraction devices will be provided to extract the beam by resonant extraction. Much of this equipment would be obtained from the Main Ring.

Superconducting Magnets

This project will provide for the completion of magnets up to the level of 774 superconducting dipole magnets and 216 superconducting quadrupole and correction elements required to complete the superconducting ring. The magnets and magnet components provided through this project are in addition to those which can be selected from magnets produced under the R&D project through which the initial designs were developed.

Project Status (December 1979)

The magnets were being fabricated and other systems were being procured. Installation of equipment within the existing accelerator had not begun.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1979	12,000	12,000	12,000
1980	26,900	15,000	15,000
1981	7,700	19,600	19,600
1982	0	0	0

PROJECT 78–10–B, INTERSECTING STORAGE ACCELERATOR (ISABELLE) 400X400 Gev, BROOKHAVEN NATIONAL LABORATORY

Fiscal year 1981 authorization	**$65, 000, 000**
Total estimated cost	**275, 000, 000**

Purpose

Just as the large number of atomic nuclei are understood in terms of two more elementary particles, the proton and neutron, this spectum of subnuclear particles is thought to be understandable in terms of a few still more elementary particles, the quarks. The picture is still rudimentary and speculative, but it suggests many crucial lines of experimentation. What are the quarks like? What spin, charge, and other quantum numbers do they carry? How are they distributed within the nucleon? Do they have an independent existence—can they be produced separately at high energies—or can they live only together as they are thought to do within the nucleon? Are there new quantum numbers, such as the recently discovered charm, and will they be manifest by new, massive, long-lived particles? ISABELLE is essential for observing higher mass analogues of the J/psi particles up to masses to 70 GeV.

In addition to the very strong nuclear forces with which the nucleons interact, they also interact through the electro-magnetic forces and through a weak force which leads, for example, to the instability of the neutron through decay. At nuclear distances, the electromagnetic force is about 100 times weaker than the strong force, and the weak force about 10 times weaker. As the energy of the colliding proton is increased, the effective difference in strength between these interactions is expected to decrease; in fact, there is already experimental evidence that it does so.

Project Description

This project will provide an intersecting storage accelerator adjacent to the Alternating Gradient Synchrotron (AGS). It will consist of two rings of superconducting magnets capable of accelerating and storing proton beams at energies up to 400 GeV in a tunnel of approximately 4000 meters in circumference, six interaction regions for simultaneous experimental studies, support and service buildings, and supporting roads, drainage, and utility systems. Protons of 29.4 GeV will be injected from the AGS into each ring in counter-rotating directions, accelerated to an energy as high as 400 GeV, held in storage, and then directed into controlled collisions at any of the six interaction regions.

Each ring will be composed of superconducting magnets operating at a magnetic field of 50 kilogauss at the full beam energy of 400 GeV. An ultra-high vacuum system set at a pressure of 3×10^{-11} torr or less will minimize proton-gas interactions. The refrigeration system to maintain the required low temperature of 4° Kelvin will include four 5500 hp dry screw compressors adsorber beds, a helium distribution and storage system and a local control system. Two radiofrequency (RF) systems will be provided: a stacking system to build pulses from the injected beam to required beam intensity, and an accelerating system.

Conventional construction will include the main magnet tunnel, injector tunnels, four research halls, a service building, seven support buildings, two hardstand areas and a gas storage yard, and supporting roads, drainage and utility distribution systems.

The magnet and injector tunnels will be constructed of multi-plate steel arch on a concrete foundation covered with 10 to 20 feet of earth shielding. Construction will be by the cut and cover method. A muon shield of earth approximately 275 feet wide and 11 feet high will be provided radially along the northeast, northwest and southeast sextants of the main tunnel. The four research halls (lepton, hadron, small angle and wide angle hall) will be constructed of reinforced concrete covered with earth shielding to approximately 13 feet. Direct vehicle access to grade and to the experimental level will be provided and a personnel/utility tunnel will connect each hall to adjacent support buildings. A paved yard of approximately 15,000 gross feet will be provided at each hall.

Project Status (December 1979)

Construction work war proceeding on the accelerator ring. The concrete foundation was being poured and the steel tunnel walls erected. At the same time, work was proceeding with the fabrication of magnets.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1978	10, 500	5, 000	5, 000
1979	23, 000	23 000	23, 000
1980	241, 500	45, 000	45, 000
1981	0	45, 000	45, 000
1982	0	50, 000	50, 000
1983	0	50, 000	50, 000
1984	0	40, 000	40, 000
1985	0	17, 000	17, 000
1985	0	0	0

PROJECT 81-E-222, GENERAL PLANT PROJECTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	**$2, 800, 000**
Total estimated cost	**2, 800, 000**

Purpose

This project is required to provide for minor new construction, other capital alterations and additions, and for improvements to land, buildings and utility systems. Where applicable, the request also includes the cost of installed capital equipment integral to a subproject. No significant R&D program is anticipated as a prerequisite for design and construction of the subprojects under construction.

Project Descriptions

Lawrence Berkeley Laboratory $2, 100

Requirements include: additional space for advanced accelerator research activities ($300,000); expansion of laboratory space for preparation and staging of Bevalac and 88-inch heavy ion nuclear experiments ($375,000); protective cover and crane capability in SuperHILAC experimental area ($475,000); safety, physical security, and operational efficiency improvements to existing buildings ($525,000); andn upgrading of mechanical and electrical utilty systems to increase reliability and safety and to decrease maintenance costs ($425,000).

Los Alamos Scientific Laboratory (LAMPF)	$400

Requirements include: remote maintenance technology facility for development and mainteance of equipment able to function in the high radiation environment of LAMPF's target cells and beam stop remote handling equipment ($300,000) and a warehouse building to replace temporary storage facilities ($100,000).

Massachusetts Institute of Technology (Bates Linear Accelerator)	$300

Requirements include: conversion of the existing RF gallery heating and ventilating systems to an integrated heating, ventilation, and air conditioning system to reduce the failure rate of high voltage and control equipment ($300,000).

Project Status

This is a new start in Fiscal Year 1981.

PROJECT 81–E–223, ARGONNE TANDEM-LINAC ACCELERATOR SYSTEM (ATLAS), ARGONNE NATIONAL LABORATORIES

Fiscal year 1981 authorization	**$400, 000**
Total estimated cost	6, 900, 000

Purpose

The ATLAS facility will permit a study of the energy dependence of complex processes such as particle transfer, quasi-elastic and deep-inelastic scattering, fusion and fission in the region where it appears that major qualitative changes in behavior occur. A limit to fusion of systems of high angular momentum has been suggested in experiments at present accelerators. ATLAS will be able to explore this scientific issue throughly. Other limits of fusion, such as might be imposed by the energy of the system, can be identified. The mechanisms by which energy and matter are exchanged between projectile and target nuclei varies with projectile, target and bombarding energy, but in ways which are not yet known.

ATLAS is designed to provide beams that have energies far above the Coulomb barrier for projectiles in the lower half of the periodic table. The emphasis on projectiles from the lower half of the periodic table is a deliberate limitation on the scope (and the cost) of the project. This choice in no way limits the possibilities for future expansion of the linac.

Under the proposed project, the expansion of the tandem superconducting booster facility at Argonne will approximately double the maximum energy and mass range of projectiles and will add a second, larger, experimental area. With this capability and the ability to accommodate two simultaneous users, ATLAS will become a powerful and unique user-oriented national facility for the exploration of nuclear structure with heavy-ion projectiles. ATLAS will be operated as a national facility for the general benefit of the nuclear physics community.

Project Description

This project provides for the construction of an advanced heavy-ion accelerator system consisting of two major components: (1) the existing FN–tandem Van de Graaff accelerator and (2) a superconducting linear accelerator complex formed by expansion of the prototype heavy-ion energy booster. The principal modifications and additions are: (a) improvement of the ion-source system and the terminal of the tandem accelerator, (b) fabrication and installation of three additional superconducting-linac sections which provide about 25 million volts of accelerating power, (c) construction of a tunnel to house the linac, and (d) construction of a new experimental area consisting of a large target room to be used with ion beams from ATLAS and a small data-recording room.

A new 3200 sq. ft. target room will be formed by a steel, prefabri- with concrete and earth radiation shielding. The associated data recording room (1000 sq. ft.) will be one-story masonry construction. The linac tunnel (1,275 sq. ft.) will be constructed of reinforced concrete. Major pieces of mechanical and electrical service equipment will be housed in a masonry utility shed (625 sq. ft.). Interconnecting passage ways (375 sq. ft.) are included.

The project includes funds to split the ion beam from the linac and direct it independently into two experimental areas: (1) the area which is used with the existing booster and (2) the new experimental area. The experimental space is partitioned into several independent areas by means of moveable radiation-shielding blocks.

A 40 degree bend in the beam direction near the midpoint of the linac permits the beam to be split and to be directed simultaneously (in every micro-pulse) into the two target areas. This is possible and exceptionally cost effective because, at the location of the bend, the beam normally contains ions with several charge states, only one of which would ordinarily be used. Thus, two beams can be formed without loss of useful intensity. The 40 degree bend also has the advantage of placing the new experimental hall in an open area where construction problems are reduced and where disruption of the ongoing research in the existing target area can be kept to a minimum.

The main component of the proposed accelerator system is a superconducting linac consisting of an array of independently-phased resonators of the spli-ring type grouped into 7 accelerator sections. The technology for this system has been developed at Argonne, where a prototype linac to boost the energy of heavy ions from the FN tandem has been developed. All aspects of the technology (resonators, cryostats, beam bunching, rf control, et.) have been thoroughly tested.

Project Status

This is a new project start in fiscal year 1981.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations	Costs
1981	6, 900	4, 000	4, 000	1, 000
1982	0	2, 900	2, 900	3, 500
1983	0	0	0	1, 900
1984	0	0	0	500

PROJECT 80–GS–5, NATIONAL SUPERCONDUCTING CYCLOTRON LABORATORY MICHIGAN STATE UNIVERSITY

Fiscal year 1981 authorization	**$8,900,000**
Total estimated cost	**30,000,000**

Purpose

The primary purpose of the National Superconducting Cyclotron Laboratory is to study the collisions of heavy ions and the nuclides they produce in a new region of energy and intensity. A heavy ion is the nucleus of any atom heavier than helium. The available energies, up to 200 MeV per nucleon for ions lighter than calcium and up to about 20 MeV per nucleon for uranium, span a critical transition region. At projectile velocities below approximately 14 MeV per nucleon, the dominant effects of the electric field of the nucleus and "quantum" effects prevent substantial deviations from "normal" behavior of nuclear matter. At the other extreme of very high energies (greater than about 150 MeV per nucleon) individual nucleon-nucleon collisions dominate, and nuclei are well described as collections of independently moving nucleons. It is in the intermediate region between these extremes, where the projectile begins to compress the nuclear matter of the target significantly, that new phenomena and new aspects of nuclear behavior are most likely to occur. It is here that one best seeks the answers to questions concerning the relative importance of the central nuclear field in heavy ion collisions, whether shock waves are produced, and the related question of whether there is a fluid-like flow of nuclear matter. This project will make possible other studies extending the knowledge of nuclear science. The total number of known nuclides will be greatly extended toward the boundaries of nuclear stability, which are important in testing theories of nuclear structure and the astrophysical formation of the elements. Studies of nuclei in the extreme conditions produced during heavy ion collisions will be of great benefit in furthering an overall understanding of nuclear phenomena.

Project Description

A superconducting cyclotron with an energy constant of 800 million electron volts (MeV) will be installed in a West Building addition (4,000 sq.ft.) extending the present high bay crane area of the Cyclotron Laboratory. This new superconducting cyclotron will be arranged to provide a second stage of acceleration for beams from the present superconducting cyclotron, which has an energy constant of 500 MeV. A stripping foil at the injection point of the second cyclotron will increase the ion charge by a factor of 2 to 4 depending on the ion, and this in combination with the larger energy constant of the second cyclotron will give a total energy increase of approximately 20 fold. The coupled cyclotron system will then produce energies of 200 MeV per nucleon for projectiles lighter than calcium and a decreasing energy per nucleon for heavier projectiles, to a value of about 20 MeV per nucleon for uranium. (Nucleon is the generic name for protons and neutrons.)

The facility will be designed as a national facility with capacities to support a large user organization. As East High Bay addition (about 7,000 sq.ft.) will house 5 new experimental areas. These, together with

4 existing areas, will provide for 15 experimental stations. Provision is made for a large magnetic spectrometer of advanced design. The facility plan includes an expanded office area (about 20,000 sq.ft.) to handle additional data processing facilities and to provide space for an expanded operating staff and for visiting scientists. Approximately 6,000 sq.ft. of the present laboratory will be remodeled to provide improved access to the new facilities.

Adequate shielding will be provided by a combination of walls constructed of poured concrete and solid concrete blocks. Wall thicknesses will range from 5 to 10 feet depending upon location, and beam dumps will be shielded with an additional 5 feet of steel. An existing 40 ton bridge crane with a 70 ft. span will service the new cyclotron vault and the experimental areas. Overhead shielding will consist of premanufactured solid concrete beams with lifting fixtures such that the beams can be installed or removed by the crane, allowing easy access to internal equipment for installation and maintenance. Architectural treatment will match the existing facilities and utility distribution systems will be extended from existing plant services.

Project Status

The project has been started with initial engineering and elevation of required equipment.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	6,000	6,000	6,000
1981	24,000	8,900	8,900
1982	0	9,100	9,100
1983	0	6,000	6,000
1984	0	0	0

PROJECT 81–E–221, ACCELERATOR IMPROVEMENTS AND MODIFICATIONS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$1,600,000
Total estimated cost	1,600,000

Purpose

These subprojects are required to maintain efficient operations at various accelerator facilities. New experiments frequently require specific changes in equipment, new target assemblies anad diagnostic equipment.

Project Descriptions

a. **Brookhaven National Laboratory**	$300

A system will be installed on the double MP tandem van de Graaff to provide nanosecond pulsing for all three stages for all ions heavier than carbon.

b. **Lawrence Berkeley Laboratory**	$500

A new beam bunching system will be installed on the SuperHILAC. The 20 MeV Bevatron injector will be upgraded by replacement of its ion gun with an improved model. At the 88-inch cyclotron, a fast beam pulsing system, a computer-based cyclotron readout and control system, and a gas handling system will be installed.

c. Oak Ridge National Laboratory	$200

An alkali metal, charge exchange ion source will be installed in the Holifield injector system.

d. Los Alamos Scientific Laboratory	$600

The transition region of the LAMPF linac will be upgraded by installation of improved bending, steering, and focusing magnets; beam diagnostic instrumentation; support structures; power supplies and regulators; and control, water, and vacuum systems.

Project Status

This is a new project initiated in fiscal year 1981.

PROJECT 81-T-501 ISOTOPES RESEARCH AND DEVELOPMENT LABORATORY, LOS ALAMOS, N. MEX.

Fiscal year 1981 authorization	**$1,500,000**
Total estimated cost	**16,000,000**

Purpose

The principal objectives of the LASL Advanced Isotope Separation Technology Program are: (1) to perform the necessary research to evaluate the physics and chemistry of new laser-induced processes and (2) to develop the components and equipment required to establish the technical feasibility of these processes for further development into prototype hardware. Emphasis is placed on those processes which appear to promise an economic advantage over existing processes, specifically the enrichment of uranium. This includes material provision at reduced cost, cost savings in required processes, and reduced dependence on imports. An important aspect of the program is the development of a technical data base for the evaluation of photoseparation processes in general. This particularly applies to developing an understanding of the scaling factors associated with each concept.

Project Description

The project consists of constructing and equipping two new structures immediately west of the present laser isotope separation activities currently housed in facilities within an existing security area at the Los Alamos Scientific Laboratory (LASL). The security fence will be enlarged to enclose the new facilities to be provided by this project.

One structure will be a laboratory and office building with a gross floor area of approximately 56,000 square feet. Approximately 65% of this area will consist of laser, spectroscopy, chemistry, and electronic laboratories, and 35% of the area will be devoted to office space. This facility is proposed as a three-story building having reinforced concrete framing and block fill with inside partitions of steel studs and dry wall. One freight elevator and one passenger elevator are proposed for this structure. The overall dimensions are approximately 200 feet long by 94 feed wide by 40 feet high with a basement mechanical equipment room.

The second structure is a warehouse 100 feet long and 50 feet wide. This is a pre-engineered commercially available metal structure without insulation or heating. It will include electrical service for lighting and minimal 120/208 Vac service outlets. It will have a dry pipe sprinkler fire protection system.

Utilities for this project will include electrical power from nearby 13.2 kV feeders, a 750 kV substation, water, natural gas, and sanitary sewer lines to a nearby treatment facility for which upgrading is included to accommodate the increased usage associated with this project.

Project Status

This is a new project in fiscal year 1981.

FINANCIAL STATUS

Fiscal year	Authorizations	Appropriations	Obligations
1981	$16,000	$1,175	$1,175
1982	0	14,825	14,825
1983	0	0	0

PROJECT 81–T–502, ADVANCED ISOTOPE SEPARATION LABORATORY, LIVERMORE, CALIF.

Fiscal year 1981 authorization	$1,800,000
Total estimated cost	29,700,000

Purpose

The principal objectives of the LLL Advanced isotope separation technology program are: (1) to perform the necessary research to evaluate the physics and chemistry of new laser-induced processes and (2) to develop the components and equipment required to establish the technical feasibility of these processes for further development into prototype hardware. Emphasis is placed on those processes which appear to promise an economic advantage over existing processes, specifically the enrichment of uranium. An important aspect of the program is the development of a technical data base for the evaluation of photoseparation processes in general. This particularly applies to developing an understanding of the scaling factors associated with each concept.

Project description

Two laboratories will be constructed; a light and medium general purpose laboratory and a heavy laboratory to house the Development Module.

This proposed 113,000 gross square foot facility will provide the laboratories, support equipment, and office facilities for the research and development of the photochemical process for isotope separations. The facility will consist of 58,400 square feet of multistory office area for 175 people, including a briefing room, and 54,600 square feet of attached light and medium laboratory area.

The light and medium laboratories will consist of a high bay laboratory with a bridge crane, six medium laboratories with monorail cranes, ten light laboratories, a radiochemistry laboratory, an equipment and assembly area, an electrical component service shop, a photography area, a vault, and miscellaneous support space.

This proposed 36,000 gross square foot facility will provide high bay laboratories and extensive low bay laboratory space with bridge cranes, a liquid materials laboratory, a dye handling laboratory, a materials clean up area, a control and diagnostic room, a laser test area, and miscellaneous support space.

Project status

This a new start in Fiscal Year 1981.

FINANCIAL SCHEDULE

[In thousands of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	29,700	6,500	1,500
1982	0	23,200	23,200
1983	0	0	0

PROJECT 81–T–504, GENERAL PLANT PROJECTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$2,970,000
Fiscal year 1981 authorization	$2,970,000

Purpose

General plant projects are undertaken to provide for modifications, repairs, additions and new plant and capital projects of a general nature.

Description of Facilities

Albuquerque, Los Alamos Scientific Laboratory	$970
Building modifications	250

The preprototype system consists of a Continuous flow recirculating loop (CFRL), a kilohertz pulse-rate infrared laser, a kilohertz pulse-rate ultraviolet laser and ancillary equipment. The space needed to house the system far exceeds that available, which means that existing supporting experiments will have to be relocated to other buildings. The supporting experiments are key elements in meeting programmatic milestones. Furthermore, since major components in the laser systems have a limited service life, basic parameters for the preprototype system will be determined in supporting ing experiments. Cost and procurement time of the preprototype system also dictate the need to continue supporting experiments. The GPP funds requested here will be used to modify and service those buildings in which supporting experiments will be relocated.

Preengineering building	$720

This proposed project consists of constructing a one story, preengineered, high bay building with a two ton crane immediately west of and adjacent to the Pulsed Recirculating Loop (PRL) laboratory building to be constructed in 1980. The proposed building will have a second Continuous Flow Recirculating Loop (CFRL) and ancillary equipment. The compressor room concrete floor will be isolated to minimize transmitted vibration. A ventilation and water chilled water system will be required for the compressor room.

San Francisco, Lawrence Livermore Laboratory	**$600**
Laser electro-optical component development lab space	**400**

Additional laboratory space is required for laser component development, testing and assembly. As more laser power comes on line continuous operation is required for a laser burn-in area, a clean room area for quality control of laser tubes, a testing area, and an assembly area. Without the GPP facility, reliable operation of the lasers will remain problematical with the result being difficulty in performing process and enrichment experiments.

Building modifications ---------- **$200**

These projects include building modifications, utilities upgrading, heating, ventilation and air conditioning systems upgrading, paying, supplemental building additions, major building repairs, central computer connections, lighting, communication systems, fire sprinklers, alarms, and general safety projects.

Oak Ridge, Gaseous diffusion plant ---------- **$700**

This project consists of two major subtasks: upgrading the compression system to provide for greater throughput and compression ratio and installing a cold trapping unit on the UF_6/carrier gas separation system.

The first task will involve building new bases for four compressors and mounting speed increasers between the motors and compressors. This upgrading is required to accommodate larger nozzles and to allow other carrier gases to be evaluated in the Large equipment test facility (LETF).

The cold traps will be used to control the inventory of UF_6 of various assays in the facility and will also serve as prototypes for components of the Molecular process development module.

Without these modifications, the LETF will be severely limited in the types of experiments that can be run in the future.

Oak Ridge, Y–12 plant ---------- **$700**

This project will upgrade the laboratory support systems in an existing building to the capabilities required for further development of the uranium handling portions of the atomic vapor and plasma advanced isotype separation processes. Included are tie-in to cooling water systems, providing adequate bus capacity for the electrical system, installing suitable drains, upgrading the ventilation system, and partitioning off the work spaces.

Since the advancement of uranium handling technology is on the critical path for development and demonstration of the atomic vapor and plasma processes, failure to provide adequate laboratory capability will result in not being able to prototype the materials handling systems prior to fabricating the development module thereby delaying the development module.

Project Status

This is a new start in fiscal year 1981.

PROJECT 78–5–C, LASER ISOTOPE SEPARATION FACILITY (TECHNOLOGY DEMONSTRATION PLANT), RICHMOND, WASH

Fiscal year 1981 authorization	$1,000,000
Total estimated cost	Undetermined

Purpose

To provide a facility demonstrating integrated light vapor technology for an atomic vapor light isotope separation system.

Description of Facilities

The project consists of the construction of a building, site utilities, and the fabrication and installation of equipment. Such equipment will include the laser systems, uranium vapor generation systems, uranium handling equipment and uranium light vapor interaction equipment.

Project Status

The $3,500,000 previously authorized was not appropriated. Therefore, in essence, this project is a new start in fiscal year 1981.

PROJECT 81–R–501, GENERAL PLANT PROJECTS, GASEOUS DIFFUSION PLANTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$17,500,000
Total estimated cost	$17,500,000

Purpose

To maintain satisfactory and economical operating conditions and to accommodate new program development and changes in programs.

Facility Description

A total of over 30 specific projects, involving such entities as materials handling, site facilities, space air conditioning, electrical and instrumentation, waste water and equipment repair and replacement.

Process Description

All projects support gaseous diffusion and related processes.

Project Status

Fiscal year 1981 authorization will initiate all projects.

Project Schedule

Congressional authorization, fiscal year 1981.
Design starts, first quarter fiscal year 1980.
Construction starts, first quarter fiscal year 1980.
Operation starts, third quarter fiscal year 1982.

PROJECT 81–R–502 UF_6 CYLINDERS AND STORAGE YARDS, GASEOUS DIFFUSION PLANTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$8,000,000
Total estimated cost	8,000,000

Purpose

To provide new cylinders and cylinder handling equipment at the three gaseous diffusion plants (Oak Ridge, Tenn.; Paducah, Ky.; and Portsmouth, Ohio).

Facility Description

Over 400,000 square feet of total outside surface will be prepared for UF_6 tails cylinder storage.

Process Description

The withdrawal of UF_6 tails materials from the gaseous diffusion plants into cylinders for long-term retention is necessary to support cascade operations. The filled cylinders weigh nearly 35,000 pounds and require prepared surfaces with appropriate storage saddles.

Project Status

Fiscal Year 1981 authorization will initiate all projects.

Project Schedule

Congressional authorization, Fiscal Year 1981.
Design start, First Quarter, Fiscal Year 1981.
Construction start, Second Quarter, Fiscal Year 1981.
Operation start, Fourth Quarter, Fiscal Year 1983.

PROJECT 81-R-503 UTILITIES UPGRADING, GASEOUS DIFFUSION PLANTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$27,000,000
Total estimated cost	27,000,000

Purpose

To improve the mechanical reliability and the operational efficiency of some vital utility systems serving the gaseous diffusion cascades.

Facility Description

Several process support systems, such as cooling water, sanitary water, electrical and nitrogen, are approaching forty years of service, are no longer reliable, and are costly to maintain.

Process Description

All projects support the gaseous diffusion process.

Project Status

Conceptual designs are complete.

Project Schedule

Congressional authorization, Fiscal Year 1981.
Design starts, First Quarter, Fiscal Year 1981.
Construction starts, Third Quarter, Fiscal Year 1981.
Operation starts, First Quarter, Fiscal Year 1985.

PROJECT 81-R-504 SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEMS, PADUCAH, KY. AND PORTSMOUTH, OHIO

Fiscal year 1981 authorization	$13,000,000
Total estimated cost	13,000,000

Purpose

To install a supervisory control and data acquisition system at the Paducah, Kentuck and Portsmouth, Ohio, Gaseous Diffusion Plants to monitor the critical parts of the high voltage switchyards and the power distribution networks.

Facility Description

The systems will be similar to the Oak Ridge installation made in FY 1978 and will consist of computers and associated hardware and software connected to existing signal sources. The new systems will include redundancy to provide a high degree of accuracy and fail-safe assurance.

Process Description

Both systems will be modified to support each gaseous diffusion process.

Project Status

Conceptual designs are complete.

Project Schedule

Congressional authorization, fiscal year 1981.
Design starts, first quarter, fiscal year 1981.
Construction starts, third quarter, fiscal year 1981.
Operation starts, second quarter, fiscal year 1985.

PROJECT 81–R–505 INSTRUMENTATION FOR PURGE CASCADE AND WITHDRAWAL AREAS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$6, 000, 000
Total estimated cost	6, 000, 000

Purpose

To monitor the purge cascade and the tails and product withdrawal systems for temperature, compressor vibration, and out leakage of UF_6.

Facility Description

The automated data processing monitoring system being provided to the gaseous diffusion plants through the Cascade Uprating Program will be expanded to the purge cascades and to selected withdrawal areas.

Process Description

The three gaseous diffusion plants will be modified to support the individual processes.

Project Status

Conceptual designs are complete.

Project Schedule

Congressional authorization, fiscal year 1981.
Design starts, first quarter, fiscal year 1981.
Construction sarts, third quarter, fiscal year 1981.
Operation starts, first quarter, fiscal year 1984.

PROJECT 81–R–506, ENVIRONMENTAL PROTECTION AND SAFETY MODIFICATIONS, PHASE I, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$36, 000, 000
Total estimated cost	55, 000, 000

Purpose

To reduce the discharge of pollutants to nearby streams and to pretreat and dispose of the solid waste generated at each site.

Facility Description

A wide variety of chemical, physical and biological facilities will be provided to treat effluents from such activities as coal storage, steam production, metals processing, decontamination, chromium and fluoride removal, degassing, electroplating, and acid neutralization.

Process Description

The installations at the three gaseous diffusion plants will be modified to support the individual plant processes.

Project Status

Conceptual designs have been completed and research and development necessary to support construction has been started.

Project Schedule

Congressional authorization, fiscal year 1981.
Design starts, first quarter, fiscal year 1981.
Construction starts, fuorth quarter, fiscal year 1981.
Operation starts, furth quarter, fiscal year 1985.

PROJECT 80–UE–1 CONTROL OF GASEOUS EFFLUENTS, OAK RIDGE, TENN. PADUCAH, KY.

Fiscal year 1981 authorization	$4, 700, 000
Total estimated cost	7, 000, 000

Purpose

To control the release of airborne effluents emanating from routine operations.

Facility Description

Wet scrubbers and chemical absorbers will be installed to capture emissions from various units, increasing fluoride abatement to meet the 1977 amendment to the Clean Air Act.

Process Description

Emissions from the Paducah ???? Burping Station and Purge Cascade and from the Oak Ridge Fluoride and Diffusion Pilot Plants do not meet the allowable rates, as deferred by the Clean Air Act, as recently amended.

Project Status

Conceptual designs are completed, detailed designs (Title II) have been initiated, and construction has been started.

Project Schedule

Congressional authorization, fiscal year 1980.
Design starts, first quartr fiscal year 1980.
Construction starts, third quarter fiscal year 1980.
Opration starts, first quarter fiscal year 1984.

PROJECT 80–UE–2 CONTROL OF WATER POLLUTION, VARIOUS LOCATIONS

Fiscal Year 1981 authorization	$9,500,000
Total estimated lost	17,000,000

Purpose

To reduce the discharge of pollutants and to control accidental releases of hazardous or polluting materials to the nearby stream.

Facility Description

Facilities will be provided for acid neutralization, pH adjustment, oil skimming, chromate removal, improved sewage collection and treatment, hydrologic stabilization, and spill control.

Process Description

Pollution control facilities will be designed to process individual streams at the three gaseous diffusion plants.

Project Status

Conceptual designs are completed and detailed design (Title II) has been started.

Project Schedule

Congressional authorization, fiscal year 1980.
Design starts, first quarter fiscal year 1980.
Construction starts, third quarter fiscal year 1980.
Operation starts, first quarter fiscal year 1984.

PROJECT 80–VE–3 PLANT FACILITIES SECURITY IMPROVEMENTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$12,500,000
Total estimated cost	17,000,000

Purpose

To improve security protection and to improve capability of plant protection forces.

Facility Description

Critical outlying support facilities, such as water systems and communications stations, will be protected with improved or new fencing, lighting, and intrusion and detection systems.

Process Description

Security systems will be designed for the individual needs of the three gaseous diffusion plants.

Project Status

Conceptual designs are completed, and detailed design (Title II) has been started.

Project Schedule

Congressional authorization, fiscal year 1980.
Design starts, first quarter, fiscal year 1980.
Construction starts, fourth quarter, fiscal year 1980.
Operation starts, first quarter, fiscal year 1984.

PROJECT 80–UE–4 POWER RECOVERY DEMONSTRATION CELLS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$7,000,000
Total estimated cost	10,500,000

Purpose

To demonstrate the feasibility of power recovery in gaseous diffusion equipment at all three gaseous diffusion plants.

Facility Description

Gaseous diffusion heats of compression will be removed by vaporizing low-boiling fluids in closed systems. The vapors drive turbines installed as compressor motor assist units, carrying a part of the load.

Process Description

The gaseous diffusion process uses large amounts of electrical power to operate the thousands of motors required by the process. These motors drive large compressors which pump gaseous UF_6 through the thousands of diffusers and interconnecting piping to achieve the desired enrichment. More than 90 percent of this energy is transformed during the compression phase into heat which is dissipated to the atmosphere through cooling towers.

Project Status

Process engineering and designs are completed and detailed designs (Title II) have been initiated.

Project Schedule

Congressional authority, fiscal year 1980.
Design start, third quarter, fiscal year 1979.
Construction starts, third quarter, fiscal year 1980.
Operation starts, second quarter, fiscal year 1983.

PROJECT 80–UE–5 MOTOR AND SWITCHBOARD UPGRADING, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$20,600,000
Total estimated cost	28,500,000

Purpose

To provide a systematic upgrading of electrical motors and electrical switchgear which, due to age, are obsolete and unreliable.

Facility Description

Process motors at Paducah and Portsmouth will be re-wound and some of the process and auxiliary switchgear at all three gaseous diffusion plants will be replaced.

Process Description

Inadequate motor winding and insulation result in loss of power and unreliable switchgear result in loss of circuit protection.

Project Status

Conceptual designs and schedules are completed. Construction items are being purchased.

Project Schedule

Congressional authorization, fiscal year 1980.
Design start, first quarter fiscal year 1980.
Construction start, third quarter fiscal year 1980.
Operation start, first quarter fiscal year 1985.

PROJECT 76-8-9 ENRICHED URANIUM PRODUCTION FACILITIES, PORTSMOUTH, OHIO

Fiscal year 1981 authorization	**$116,325,000**
Total estimated cost	**1,121,630,000**

Purpose

To provide approximately 8.8 million separative work units (SWU) per year of additional enrichment capacity through construction of new gas centrifuge enrichment facilities which will consist of eight process buildings, necessary auxiliaries, and other administrative, support, test, and service facilities as required.

Facility Description

New and modified facilities will be provided, such as hot water pumping facilities, sanitary water facilities, and electric switching facilities as required. Temporary construction buildings, facilities, and equipment will also be provided for the construction contractor(s). Railway spurs, roads, and other land improvements will be provided as required. Certain other new and/or modified facilities will be provided at the production site and the development sites, such as administration facilities, training facilities, and test facilities.

Process Description

Each process building consists of operating bays containing the centrifuges, plus service bays containing all auxiliary equipment. The recycle/assembly building will be a multi-level enclosed building with an open area for receiving and storage. Facilities provided will include incoming parts receiving and storage; uprighting and balancing stations for rotors; assembly areas with conveyors and fixtures for assembly of all major subassemblies; equipment for vacuum testing; final inspection stations; disassembly stands; decontamination facilities; scrap processing stations; office areas; and maintenance facilities.

Project Status

All activities are being continued; engineering design, specification, procurement and construction.

Project Schedule

Congressional authorization, fiscal year 1976.
Design start, fiscal year 1976.
Construction start, third quarter fiscal year 1979.
Operation start, fiscal year 1993.

PROJECT 71-1-f PROCESS EQUIPMENT MODIFICATIONS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	**—$111,600,000**
Total estimated cost	**990,000,000**

Purpose

To incorporate the most recent advances in gaseous diffusion technology into the existing process equipment in all three gaseous diffusion plants

Facility Description

Installation of improved barrier in 3,167 stages by the end of fiscal year 1981.

Process Description

The Cascade Improvement Program is needed to help meet the projected increase in requirements for separative work, both in this country and in other nations under cooperative arrangements with the United States. Although the CIP will fulfill only a fraction of the rapidly developing requirements, the unit cost of the resultant gain in production capacity is so favorable that this work assumes a position of strong precedence in the steps that can be taken to meet these future requirements. The modification of all cascade components for higher efficiency will raise the separative capacity of the entire complex by about one-third at a total cost, including support facilities, of about $1,097,000,000. The gain of 5.5 to 5.8 million SWU/yr. of separative work a 6,100 MW is obtainable at an attractively low unit cost, including amortization of all support facilities, of about $21–$22/SWU compared to DOE current charges of $89.19/SWU under existing requirement type contracts and $88.65/SWU under the long-term fixed-commitment type contracts.

Project Status

Engineering specifications have been completed.

Project Schedule

Congressional authorization, fiscal year 1971.
Design start, fiscal year 1972.
Construction start, fiscal year 1972.
Operation start (tentative), first quarter, fiscal year 1982.

4. ENERGY DEVELOPMENT AND APPLICATIONS

The Subcommittee has jurisdiction over the research, development, and demonstration of fossil energy, solar applications and technology and conservation construction projects. The Subcommittee also has jurisdiction over projects in the areas of supporting conversion research, fossil fuels extraction and processing and environmental control technology.

The total amounts authorized for construction work (plant and capital) for Fiscal Year 1981 were:

	Thousands
Fossil energy	$378, 700
Solar technology	41, 050
Subcommittee Total	419, 750

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATION

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS

[In thousands of dollars]

Project No. and description	Total estimated cost	Previous authorization	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authorized through fiscal year 1981
FOSSIL ENERGY							
Coal Liquefaction							
78-2-d—SRC-1 (Solids) Demonstration Plant, Owensboro, Ky	1, 112, 000	110, 000	195, 000	NC	−45, 000	150, 000	260, 000
79-1-r—SRC-11 (Liquids) Demonstration Plant, Morgantown, W. Va	1, 015, 000	90, 000	210, 000	NC	−50, 000	160, 000	250, 000
Surface Coal Gasification							
76-1-b—High Btu Synthetic Pipeline Gas Demonstration Plant, Perry County, Ill	275, 000	122, 000	193, 000	NC	−188, 000	5, 000	127, 000
77-1-b—Second High Btu Pipeline Gas Demonstration Plant, Noble County, Ohio	275, 000	10, 000	0	NC	+38, 000	38, 000	48, 000
Advanced Research and Technology Development							
80-FE-3—Program Support Facility, Pittsburgh Energy Research Center, Pa	9, 500	1, 700	7, 800	NC	−5, 600	2, 200	3, 900
81-T-401—Renovation of South Wing Building 3-B, Bartlesville Energy Research Center, Okla	1, 200	0	1, 200	NC	0	1, 200	1, 200
81-T-402—Surface Water Containment and Waste Water Treatment Facility, Pittsburgh Energy Technology Center	3, 000	0	1, 300	NC	−1, 300	0	0
81-T-404—General Plant Projects for Technology Centers, 6 locations	6, 000	0	6, 000	NC	−3, 000	3, 000	3, 000
Combustion Systems							
81-T-405—Atmospheric Fluidized-Bed Combustion Demonstration Projects, sites undetermined	20, 000	4, 300	0	0	+10, 000	10, 000	14, 300
80-FE-10—Atmospheric Fluidized Bed Component Test and Integration Unit, Morgantown, W. Va. (prior-year appropriation as operating expenses)	49, 800	37, 200	9, 935	NC	−19, 935	−10, 000	27, 200

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATIONS—Continued

SUBCOMMITTEE ON ENERGY DEVELOPMENT AND APPLICATIONS—Continued

[In thousands of dollars]

Project No. and description	Total estimated cost	Previous author	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variance from budget	Amount authorized	Total authority through fiscal year 1981
FOSSIL ENERGY—Con.							
Combustion Systems—Con.							
80-FE-11—Pressurized Fluidized Bed Combined Cycle Pilot Plant, Woodridge, N.J. (prior-year appropriation as operating expenses)	40, 500	29, 800	9, 200	0	0	9, 200	39, 000
81-T-406—Coal-Oil Mixture Demonstration Projects, sites undetermined	7, 000	0	0	0	+7, 000	7, 000	7, 000
Fossil Energy-Production, Demonstration and Distribution							
80-FE-12—Peat-Fuel Combustion Demonstration Project, site undetermined	(¹)	0	0	0	+3, 100	3, 100	3, 100
Total construction, fossil energy			633, 435		−254, 735	378, 700	
SOLAR TECHNOLOGY							
Biomass							
80-B-1—Biomass Thermochemical Gasification Experimental Facility, site to be determined	12, 000	2, 000	2, 000	NC	−2, 000	0	2, 000
81-T-305—Ethanol from Biomass Production/Conversion System, site to be determined	(¹)	0	2, 500	NC	0	2, 500	2, 500
Solar Thermal							
76-2-b—10 MW Central Receiver Solar Thermal Power Plant, Barstow, Calif	118, 000	108, 000	10, 000	NC	0	10, 000	118, 000
80-ES-2—Shenandoah Solar Total Energy Project, Shenandoah, Ga	11, 700	5, 900	5, 800	NC	0	5, 800	11, 700
80-ES-19—Small Community Solar Thermal Power Experiment, site to be determined	(¹)	3, 795	3, 750	NC	0	3, 750	7, 545
81-T-306—Solar Industrial Cogeneration Project, site to be determined	1, 900	0	1, 900	NC	−1, 900	0	0
Solar Energy Research Institute (Title I)							
79-1-q—SERI Facility, Golden, Colo		9, 900	10, 000	1, 000	−3, 000	7, 000	16, 900
Wind Energy							
81-H-04—First Advanced Medium Scale Wind Turbine (MOD-6) Vertical Axis, site to be determined	(¹)	0	0	0	+1, 000	1, 000	1, 000
81-H-05—Second Advanced Medium Scale Wind Turbine (MOD-6), Horizontal Axis, site to be determined	(¹)	0	0	0	+1, 000	1, 000	1, 000
81-H-06—First Advanced Multi-Megawatt Wind Turbine (MOD-5), site to be determined	(¹)	0	0	0	+2, 500	2, 500	2, 500
81-H-07—Second Advanced Multi-Megawatt Wind Turbine (MOD-5), site to be determined	(¹)	0	0	0	+2, 500	2, 500	2, 500
81-H-10—6 Additional Advanced Multi-Megawatt Wind Turbines (MOD-5), various locations (cost per project not to exceed $5,000)—(prior-year projects: Wind)	15, 000	0	0	0	+5, 000	5, 000	5, 000
Total construction, solar technology			35, 950		+5, 100	41, 050	

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[1] Undetermined.

PROJECT 78–2–d: SRC–I (SOLIDS) DEMONSTRATION PLANT, NEWMAN, DAVIESS COUNTY, KY.

Fiscal year 1981 authorization	$150,000,000
Total estimated cost	1,112,000,000
Total estimated cost increase since inception	528,000,000

Purpose

To demonstrate the conversion of high-sulfur coal to a clean-burning solid fuel.

Facility description

Demonstration plant; input-6,000 tons coal per day; output-1,600 tons solid SRC, 700 tons anode coke, 6,200 barrels naphtha and oils, and 190 tons sulfur per day.

Process description

Coal is pulverized and is mixed with a solvent from the process and with hydrogen. The mixture is heated and pumped into a dissolver where the components are merged and chemical changes occur. The dissolver discharge is separated into gas, solid, and liquid phases. The gas is separated into hydrogen, which is mixed with entering coal, into sulfides for subsequent sulfur recovery, and into marketable fuel gas. The solid is essentially coal ash and is removed from the system. The separated liquid is distilled to produce re-usable solvent and light oils. The distillation residue is the primary final product, solvent refined coal, and a secondary product, anode-grade carbon.

Project status (April 1980)

Detailed design is underway. The Environmental Impact Statement is being prepared and appraisal is expected by October 1980.

Project schedule

Congressional authorization, Fiscal Year 1978.
Contract execution, July 1978.
Detailed design start, January 1980.
Construction start, April 1981.
Operation start, July 1984.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	80	80	80
Requested fiscal year 1981	195		175
Anticipated fiscal year 1982	600		550
Anticipated fiscal year 1983	237		250
Anticipated fiscal year 1984	0		57

PROJECT 79–1–r: SRC–II (LIQUIDS) DEMONSTRATION PLANT, MONONGALIA COUNTY, W. VA.

Fiscal Year 1981 authorization	$160,000,000
Total estimated cost	1,015,000,000
Total estimated cost increase since inception	431,000,000

Purpose

To demonstrate the conversion of high-sulfur coal to an environmentally acceptable liquid fuel.

Facility Description

Demonstration plant; input, 6,000 tons coal per day; output, 46 million cu. ft. gas, 11,500 barrels of synthetic crude oil, 3,900 barrels LPG and 160 tons of sulfur per day.

Process Description

Coal is pulverized and mixed with a recycle slurry stream from the process. Hydrogen is added and the mixture is heated and pumped into a dissolver, where the components are merged and chemical changes occur. The liquid portion is separated into naphtha, light fuel oils and heavy fuel oil as products. Dissolve gases are processed to produce hydrogen for slurry feed, fuel gas and sulfur for marketing, and slag (primarily coal ash) for disposal. Dissolver liquid is also recycled for coal slurry purposes.

Project Status (April 1980)

Detailed design is underway. The Environmental Impact Statement is being prepared and scheduled for August 1980 issue.

Project Schedule

Congressional authorization, Fiscal Year 1979.
Contract execution, July 1978.
Detailed design start, October 1979.
Construction start, April 1981.
Operation start, July 1984.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1981	75	90	90
Requested fiscal year 1981	210		190
Anticipated fiscal year 1982	430		425
Anticipated fiscal year 1983	300		250
Anticipated fiscal year 1984	0		60

PROJECT 76–112: HIGH BTU SYNTHETIC PIPELINE GAS DEMONSTRATION PLANT, PERRY COUNTY, ILL.

Fiscal year 1981 authorization	$5,000,000
Total estimated cost	275,000,000
Total estimated cost increase since inception	125,000,000

Purpose

To demonstrate a near-term process for the conversion of high-sulfur coal into a clean substitute for domestic natural gas.

Facility Description

Demonstration plant; input—2,210 tons coal per day; output—24 million cu. ft. 950 Btu/cu. ft. gas, 2070 barrels naphtha and synthetic oils, 56 tons sulfur and 9 tons ammonia per day.

Process Description

Coal is crushed and fed into a pressurized system of several containers called "pyrolyzers." As the coal progresses from one pyrolyzer to the next, it is heated by a counter-current stream of synthesis gas, and that gas and the coal's volatile content are discharged. The solid residue is char, or carbon, which is treated with steam and air to produce the synthesis gas. The pyrolyzer discharge is cooled to separate liquids and gases. The liquids are treated with plant-produced hydrogen to form naphta and synthetic fuel oils. The gases are purified to remove ammonia and sulfur. A portion of the cleaned gas is used to produce hydrogen, and the larger portion is catalytically converted to a high Btu (950 Btu/cu. ft.) synthetic gas.

Project Status (April 1980)

The described project is a combination of two processes—COGAS and COED—which have been separately developed in pilot plants. A decision to proceed beyond the current conceptual evaluation will be made by May 1980.

Project Schedule

Congressional authorization, fiscal year 1976.
Contract execution, July 1977.
Detailed design start, December 1978.
Construction start, April 1981.
Operation start, January 1985.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	122	95	25
Requested finscal 1981	193		50
Anticipated fiscal year 1982			100
Anticipated fiscal year 1983			85
Anticipated fiscal year 1984			15

PROJECT 77 1–B: SECOND BTU SYNTHETIC PIPELINE GAS DEMONSTRATION PLANT, NOBLE COUNTY, OHIO

Fiscal year 1981 authorization	**$38, 000, 000**
Total estimated cost	**275, 000, 000**
Total estimated cost increase since inception	**125, 000, 000**

Purpose

To demonstrate a near-term process for the conversion of high sulfur coal into a clean substitute for domestic natural gas.

Facility Description

Demonstration plant; input—1,000 tons coal per day; output—19 million cu. ft. 960 Btu/cu. ft. gas, 50 tons sulfur, 270 barrels synthetic oils and 7 tons ammonia per day.

Process Description

Crushed coal, recycled tar and a fluxing agent are fed into a heated, pressurized gasifier. Volatile components are removed and the coke remaining is gasified with steam and oxygen. The residual ash melts and flows down into a quench section of the gasifier. Solid feeds and discharges are handled by lock hoppers which prevent pressure loss. The crude gas leaving the gasifier is scrubbed to remove synthetic oils, such as tar oils, naphtha and phenols. The treated gas is reacted with steam to produce hydrogen, some of the resulting carbon dioxide is removed and the remainder is converted by a catalyst to methane. The high Btu gas is dried, compressed and transported by pipeline to users.

Project Status (April 1980)

The described project is a combination of several unit processes, such as gasification, scrubbing, methanation and sulfur recovery. A decision to proceed beyond conceptual combination of unit processes to plant size demonstration will be made by May 1980.

Project Schedule

Congressional authorization, fiscal year 1977.
Contract execution, June 1978.
Detailed design start, December 1978.
Construction start, October 1981.
Operation start, July 1985.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	10	10	25
Requested fiscal year 1981	50		25
Anticipated fiscal year 1982			100
Anticipated fiscal 1983			75
Anticipated fiscal year 1984			50

PROJECT 80-FE-3 PROGRAM SUPPORT FACILITY, PITTSBURGH, ENERGY TECHNOLOGY CENTER, PA.

Fiscal year 1981 authorization	$2,200,000
Total estimated cost	9,500,000
Total estimated cost increase since inception	700,000

Purpose

To construct and equip a building containing office, cafeteria and general utility areas.

Facility Description

New 50,000 square foot administration building on two main levels and a partial basement.

Process Description

A roadway will be provided to the building site, all located on Pittsburgh Energy Technology Center (PETC) property. The building will be used for reception, office, library, conference, mail, medical, computer and food functions.

Project Status (April 1980)

Detailed design (Title II) will be completed in the fourth quarter of fiscal year 1980.

Project Schedule

Contract execution, November 1980.
Contract executionfi November 1980,
Construction start, August 1981.
Occupancy, July 1983.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	1.7	1.7	1.7
Requested fiscal year 1981	7.8		2.2
Anticipated fiscal year 182			5.6

PROJECT 81–T–401 BUILDING RENOGATION, ENERGY TECHNOLOGY CENTER, BARTLESVILLE, OKLA.

Fiscal year 1981 authorization	$1,200,000
Total estimated cost	1,200,000
Total estimated cost increase since inception	0

Purpose

To rate a 60-year old building wing and to rebuild with fireproof materials on improved foundation.

Facility Description

South wing, Building 3, Bartlesville Energy Technology Center (BETC) utilized as office space and laboratory.

Process Description

The existing structure will be razed. A new foundation will be built at the razed site. The new building will be a fireproof structure slightly larger than the replaced building. Design attention will be directed particularly at energy conservation.

Project Status

Upon approval of the request, BETC will engage the services of an architect/engineer to design the building wing.

Project Schedule (provisional)

Congressional authorization, fiscal year 1981.
Architect/engineer start, first quarter, fiscal year 1981.
Construction start, second quarter, fiscal year 1981.
Construction completion, third quarter, fiscal year 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	1.2	1.2	1.0
Anticipated fiscal year 1982			1.2

PROJECT 81-T-404 GENERAL PLANT PROJECTS FOR TECHNOLOGY CENTERS, BARTESVILLE, OKLA.; CARBONDALE, ILL.; GRAND FORKS, N. DAK.; LARAMIE, WYO., MORGANTOWN, W. VA.; PITTSBURGH, PA.

Fiscal year 1981 authorization	3,000,000
Total estimated cost	6,000,000
Total estimated cost increase since inception	

Purpose

To provide for construction, modification, and rehabilitation of buildings, each project of insufficient magnitude to warrant line-item budgetary consideration.

Facility Description

Existing buildings and appurtenances.

Process Description

Spaces, occupied as offices and laboratories, to be upgraded to meet building, safety and health, and DOE policies and standards. Activities directed to heating, cooling, ventilation and electrical systems, structural segments and materials storage. (*April 1, 1980.*)

Project Status (April 1, 1980)

All six projects await authorization to implement design and engineering prior to construction.

Project Schedule 1

Congressional authorization, requested in fiscal year 1981.
Contract execution, early fiscal year 1981.
Construction start, fiscal year 1981.
Project completion, first quarter fiscal year 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	$3		$3
Anticipated fiscal year 1982	3		6

PROJECT 81-T-405 ATMOSPHERIC FLUIDIZED-BED COMBUSTION—INDUSTRIAL DEMONSTRATION PROJECTS, SITES UNDETERMINED

Fiscal year 1981 authorization	$10,000,000
Total estimated cost	20,000,000
Total estimated cost increase since inception	None

Purpose

To advance the commercialization of atmospheric fluidized-bed combustion through the construction and operation of several plant-site demonstration boilers at industrial sites.

Facility Description

Demonstration plants; input—in excess of 100 million Btu/hr.; output—steam at temperature and pressure as required.

Process Description

The atmospheric fluidized-bed combustion process consists of feeding coal into a container which maintains a quantity of crushed limestone. The stone is supported on a perforated plate up through which air is blown at a velocity sufficient to agitate the stone. The fluidizing air provides oxygen for combustion of the coal. Sulfur released during combustion is captured by the limestone, which is continually replaced to provide chemically-active surfaces. The combustion temperature is sufficiently low to optimize sulfur capture and to minimize nitrogen oxide generation. The combustion zone is operated at atmospheric pressure, and zone temperature is controlled by water circulating through tubes in the bed. Those tubes and others external to the fluidized bed provides steam at a faster rate than conventional coal-fired boilers. Particulate in the combustion exhaust gases is suppressed by conventional removal devices, such as bag houses and electrostatic precipitators.

Project Status (April 1, 1980)

Proposals from a DOE-sponsored competitive procurement have been evaluated and contract can be negotiated upon selection.

Project Schedule

Congressional authorization, fiscal year 1980.
Contract execution, late fiscal year 1980.
Construction start, late fiscal year 1981.
Operation start, early fiscal year 1984.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	4.3	4.3	4.3
Requested fiscal year 1981	None		9.0
Anticipated fiscal year 1982			6.7

PROJECT 80-FE-10 ATMOSPHERIC FLUDIZED BED COMBUSTION COMPONENT TEST AND INTEGRATION UNIT, MORGANTOWN, W. VA.

Fiscal year 1981 authorization	$19,935,000
Total estimated cost	58,000,000
Total estimated cost increase since inception	20,000,000

Purpose

The project was intended to support the commercialization of atmospheric fluidized-bed combustion boilers for burning a wide variety of coals in an environmentally acceptable manner.

Facility Description

Pilot plant; coal input—85 tons coal per day; output—90,000 lbs./hr. saturated steam at 150 p.s.g.

Process Description

The facility will contain a stacked, 3-bed, six-foot square fluidized-bed combustor, complete with peripheral equipment such as coal and limestone feed, particulate capture and removal units, boiler feed water and steam control subsystems. Instrumentation will be sufficiently comprehensive to measure, record and control all activities, including in-process and final emissions, heat transfer, materials flow rates, operating temperatures and air and gas pressures. Sufficient flexibility will be provided to allow for the testing of various components, enabling investigators to evaluate equipment designs, both as individual components and as contributors to the intergrated facility operation. Data processing capabilities will be provided to produce system and component efficiencies, operating characterization and design parameters.

Project Status (April 1980)

The facility building is nearly completed and the boiler assembly is underway. Escalating costs and schedule slippage have prompted project re-evaluation, and construction activity has ceased.

Project Schedule

Congressional authorization, fiscal year 1976.
Design start, April 1976.
Construction start, January 1978.
Operation start, April 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	36.7	36.7	25.0
Requested fiscal year 1981	9.9		20.0
Anticipated fiscal year 1982			13.0

PROJECT 80–FE–11 PRESSURIZED FLUIDIZED BED COMBINED CYCLE PILOT PLANT, WOODBRIDGE, N.J.

Fiscal Year 1981 authorization	$9, 200, 000
Total estimated cost	40, 500, 000
Total estimated cost increase since inception	20, 000, 000

Purpose

To confirm the technical feasibility of powering a combined cycle gas turbine with combustion gases from a pressurized fluidized bed combuster burning coal in an environmentally acceptable manner.

Facility Description

Pilot plant; input—120 tons coal per day; output—6 mw electric power and 58,000 lb./hr. of 175 psig steam.

Process Description

Crushed coal and limestone are fed into a combustor, the pressure of which is maintained at an elevated level by a compressed air stream. The coal burns, heating air which is circulating through tubes in the combustor. Sulfur released from the coal is captured by the fluidized limestone bed. Combustion gases leaving the combustor are cleaned and combined with the heated air from the in-bed tubes. The hot, compressed gases power a gas turbine, which compresses the combustion and in-tube air and operates an electric generator. Turbine exhaust gas is used to produce steam in a waste heat boiler before discharge to the atmosphere.

Project Status (April, 1980)

All sub scale testing complete. Pilot plant detailed design is complete and construction is scheduled to begin during the third quarter Fiscal Year 1980.

Project Schedule

Congressional Authorization, Fiscal Year 1977.
Contract execution, June 1977.
Detailed design start, October 1977.
Construction start, June 1980.
Operation start, July 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligation
Through fiscal year 1980	20.5	20.5	20.5
Requested fiscal year 1981	9.2	---------------	9.2
Anticipated fiscal year 1982	10.8	---------------	10.8
Anticipated fiscal year 1983	------	---------------	------

PROJECT 81-T-406—COAL-OIL MIXTURES DEMONSTRATION PROJECTS, PROJECTS, SITES UNDETERMINED

Fiscal year 1981 authorization	$7,000,000
Total estimated cost	7,000,000
Total estimated cost increase since inception	None

Purpose

To demonstrate technology of substituting coal for a substantial portion of oil in combustors capable of firing coal-oil mixtures in plant-site facilities.

Facility Description

Utility and industrial boilers, originally designed to burn fuel oil, modified to utilize coal-oil mixtures obtained from off-site sources.

Process Description

Coal is pulverized and added to fuel oil with a stabilizing agent. The mixture is stored, pumped and injected through modified burners into conventional boilers for utility and industrial steam production. The net effect is to decrease total oil consumption at the facility.

Project Status (April 1, 1980)

Proposals from a DOE-sponsored competitive procurement are in final evaluation prior to selection for contract negotiation.

Project Schedule

Congressional authorization, fiscal year 1979.
Contract execution, late fiscal year 1980.
Construction start, mid fiscal year 1981.
Operation start, early fiscal year 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	None	---------------	7

PROJECT 80-FE-12—PEAT FUEL COMBUSTION DEMONSTRATION PROJECT, SITE UNDETERMINED

Fiscal year 1981 authorization	**$3, 100, 000**
Total estimated cost	**Undetermined**

Purpose

To demonstrate the economic and environmental feasibility of utilizing peat as a regional fuel.

Facility Description

Demonstration system, consisting of peat harvesting, drying, and utilization in direct combustion.

Process Description

To be selected by competitive procurement.

Project Status

Will be initiated by this authorization.

Project Schedule (Anticipated)

Congressional authorization, fiscal year 1981.
Contract execution, fiscal year 1981.
Design start, fiscal year 1982.
Construction start, fiscal year 1983.
Operation start, fiscal year 1985.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	3.1	(1)	(1)
1982			(1)
1983			(1)

[1] To be determined.

PROJECT 76-2-B—TEN MEGAWATT CENTRAL RECEIVER, SOLAR THERMAL POWERPLANT, BARSTOW, CALIF.

Fiscal year 1981 authorization	**$10, 000, 000**
Total estimated cost	**118, 000, 000**
Total estimated cost increase since inception	**10, 000, 000**

Purpose

To demonstrate the technical requirements for this concept of utilizing solar energy, to determine performance capacities, efficiencies, and operation/maintenance costs.

Facility Description

The site consists of an open space affording unobstructed view of the sun throughout the arc described daily by the earth's rotation. The site also has existing electrical power transmission facilities which will receive the power generated from this project.

A tower will be constructed to support the "receiver" which is a boiler designed to function from the heat beamed to it by 1800 heliostats. The heliostats are mirrors, supported by metal frames mounted on pedestals, which permit their movement in two directions, up and down vertically and from side to side horizontally. This makes it possible to maintain the focus of the suns rays on the receiver at the top of the tower.

Water pumped to the receiver will be heated and transformed into steam. The steam will be supplied to a turbine generator which is to be supplied by the .

A simple thermal storage tank filled with rocks and oil will permit some retention of some heat.

Process description

The energy received from the sun (solar insolation) is reflected by the heliostats and, at the same time, focused on the receiver mounted on the top of a tower. As the sun moves throughout the day, the heliostats turn in accordance with a computer program such that the energy remains focused on the receiver. Water in the receiver is heated by this concentration of the solar insolation above the boiling point to produce steam. The steam is then allowed to expand through a turbine coupled to an electric generator which is expected to produce 10 megawatts of electric power.

Project status (April 1980)

The final design is almost complete and construction work has been started. Site grading has been completed and the pouring of concrete foundations has begun.

Project schedule

Congressional authorization, fiscal year 1976.
Detailed design start, February 1979.
Construction start, November 1979.
Operation start, September 1982.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1976	5.0	0	0
Transition quarter	1.25	0	0
1977	0	2.5	.05
1978	41.0	41.0	.568
1979	28.0	28.0	25.075
1980	36.5	36.5	83.307
1981	10.0	10.0	10.0

PROJECT 80–ES–2 SHENANDOAH SOLAR TOTAL ENERGY PROJECT

Shenandoah, Ga.

Fiscal year 1981 authorization	$5,800,000
Total estimated cost	10,600,000
Estimated cost increase since inception (credit)	697,000

Purpose

The purpose of this project is to determine the technical and cost effectiveness of using thermal energy to produce electricity while using the exhaust heat from the turbine for process steam; heating and cooling.

Facility Description

The facility will consist of a field of parabolic shaped solar receivers designed to track the sun through both its horizontal and vertical movement. Energy collected is expected to reach 3 megawatts (MW) thermal input. The electrical output from a steam turbine driven generator is expected to vary between 150 and 400 kilowatts (KW).

Not all of the steam will be used for the generation of electricity as part of it will be used for processes at an adjacent knitting factory.

Also included in the project is a computer to control the parabolic collectors such that they remain oriented toward the sun. The construction of a building to house machinery and also serve as a visitors center is included.

Site work and utilities are included.

Process Description

Solar insolation received by the parabolic collectors will be used to heat water, make steam, and drive a turbine generator. Excess steam and lower temperature hot water will be used by the factory for production, heating and cooling purposes.

Project status (April 1980)

Detailed design (Title II) is nearly completed.

PROJECT SCHEDULE

Congressional authorization	Fiscal year 1980.
Construction start	July 1980.
Operation start	October 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	4.8	4.8	4.8
1981	5.8	5.8	5.8

PROJECT 80–GS–19 SMALL COMMUNITY SOLAR THERMAL POWER EXPERIMENT, SITE TO BE DETERMINED

Fiscal year 1981 authorization	$3,750,000
Total estimated cost	24,600,000
Total estimated cost increase since inception (was alluded to in fiscal year 1981 budget	10,400,000

Purpose

To determine the technical and economic feasibility of using multiple parabolic collectors, each equipped with a small steam engine, to meet the electrical power demand of a small community.

Facility description

Sixty-five parabolic collectors each equipped with a small steam engine and electric generator located to collect the solar insulation at the focal point will be erected in a field. The output, in electrical energy, will be supplied to a small community through an existing distribution network. Power capacity is expected to be one megawatt.

Process Description

The solar insulation can be concentrated at the focal point of a collector shaped in a parabolic form. By concentrating the total energy received by the entire area of the parabola into an area that may be 1500 times smaller, the heat density is increased with resulting higher temperatures. The temperatures could be increased to the destruction point of the materials if the heat were not removed in time.

For this project, the steam engine would function in what is classified as a rankine cycle where the working fluid would be compressed isentropically, heated and then allowed to expand isentropically moving a shaft and turning a generator. The cycle could be opened or closed.

Project Status (April 1980)

The project is still in the initial stages of engineering (Title I).

Project Schedule

Congressional authorization.
Design start, undetermined.
Construction start, undetermined.
Operation start, undetermined.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	3.795	3.795	3.795
1981	3.750	3.750	3.750
1982	Undetermined	Undetermined	Undetermined

PROJECT 79–1–G SOLAR ENERGY RESEARCH INSTITUTE, GOLDEN, COLO.

Fiscal year 1981 authorization	$7,000,000
Total estimated cost	Undetermined
Total estimated cost increase since inception	Undetermined

Purpose

To provide adequate laboratory space and facilities in which research activities leading to the further development of solar energy can be performed.

Facility Description

In 1979, the total estimated space requirements were identified as 200,000 square feet including, 90,000 square feet (net) of office space, 15,000 square feet (net) for the solar data bank and library and 67,000 square feet for laboratories. By 1980, these estimates had more than doubled to 460,000 square feet without any apparent change in mission requirements.

The facility remains to be defined during fiscal year 1981.

Project Status (April 1980)

The conceptual design of a large 460,000 square foot complex was completed and preliminary engineering (Title I) started.

Project Schedule

Congressional authorization, fiscal year 1979.

Detailed design start, held—pending reevaluation.

Construction start, test site infrastructure fiscal year 1981 building—not scheduled.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1979	3.0	3.0	3.0
1980	6.9	6.9	6.9
1981	7.0		(1)

[1] To be determined.

PROJECT 81-T-305 ETHANOL FROM BIOMASS PRODUCTION/CONVERSION SYSTEM, SITE TO BE DETERMINED

Fiscal year 1981 authorization	$2,500,000
Total estimated cost	To be determined
Total estimated cost increase since inception	none

Purpose

To evaluate the latest, readily available innovations in biomass pretreatment and fermentation and alcohol distillation processes.

Facility Description

Pilot plant; input—biomass to be selected; output—2 million gallons ethanol per year.

Process Description

Selected biomass, from a supply adequate to maintain facility output, will be treated to promote optimal fermentation. The feed will be fermented to produce as high an ethanol yield as possible. Distillation will concentrate the ethanol to a marketable level. Total system—supply to product—will be evaluated.

Project Status

Conceptual evaluation is underway. Specifications are being prepared for architect/engineer selection.

Project Schedule (provisional)

Congressional authorization, fiscal year 1981.

Design start, March 1981.

Construction start, December 1981.

Operation start, March 1984.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	2.5		2.5
Anticipated fiscal year 1982			(1)

[1] To be determined.

PROJECT 81–H–04 FIRST ADVANCED MEDIUM SEALE WIND TURBINE (MOD–6) VERTICAL AXIS SITE TO BE DETERMINED

Fiscal year 1981 authorization	**$1,000,000**
Total estimated cost	**To be determined**
Total estimated cost increase since inception	**None**

Purpose

To estabish an intermediate side system competitive programs with horizontal axis wind turbine design.

Facility Description

Vertical-axis Darrieus type machine in the 100–1,000 kw output range.

Process Description

Small system evaluation of the vertical axis design indicates that in larger sizes and competitive mode this configuration may produce electric power at a cost effective rate.

Project Status

Procurement specifications are being readied for distribution.

Project Schedule (Provisional)

Congressional authorization, fiscal year 1981.
Design start, January 1981.
Construction start, October 1982.
Operation start, October 1983.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	1		1
Anticipated fiscal year 1982			(1)

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[1] To be determined.

PROJECT 81–H–05 SECOND ADVANCED MEDIUM SCALE WIND TURBINE (MOD–6) HORIZONTAL AXIS, SITE TO BE DETERMINED

Fiscal year 1981 authorization	**$1,000,000**
Total estimated cost	**To be determined**
Total estimated cost increase since inception	**None**

Purpose

To establish an intermediate site system competitive program with vertical axis wind turbine design.

Facility Description

Small system evaluation of the horizontal axis design indicates that in larger sites and competitive mode this configuration may produce electric power at a cost effective rate.

Project Status

Procurement specifications are being readied for distribution.

Project Schedule (provisional)

Congresional authorization, fiscal year 1981.
Design start, January 1981.
Construction start, October 1982.
Operation start, October 1983.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligation
Requested fiscal year 1981	1		1
Anticipated fiscal year 1982			(1)

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(1) To be determined.

PROJECT 81–II–06 FIRST ADVANCED MULTI-MEGAWATT WIND TURBINE (MOD–5), SITE TO BE DETERMINED

FY 1981 authorization	$2,500,000
Total estimated cost	To be determined
Total estimated cost increase since inception	None

Purpose

To establish a large-system development program on a parallel course with another wind turbine supplier.

Facility Description

The development model of a wind turbine having an output of electric power in excess of 1 mw.

Process Description

Extensive field testing of pioneer wind turbines indicates that incorporation of numerous design improvements will result in large-system equipment which can produce electric power at a cost-effective rate.

Project Status

System specifications are being completed for distribution prior to a competitive procurement.

Project Schedule (provisional)

Congressional authorization, Fiscal Year 1981.
Design start, January 1981.
Construction start, October 1982.
Operation start, October 1983.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	$2.5		$2.5
Anticipated fiscal year 1982			(1)

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(1) To be determined.

PROJECT 81–H–07 SECOND ADVANCED MULTI-MEGAWATT WIND TURBINE (MOD–5), SITE TO BE DETERMINED

Fiscal year 1981 authorization	$2, 500, 000
Total estimated cost	To be determined
Total estimated cost increase since inception	None

Purpose

To establish a large-system development program on a parallel course with another wind turbine supplier.

Facility description

The development model of a wind turbine having an output of electric power in excess of 1 mw.

Process description

Extensive field testing of pioneer wind turbines indicates that incorporation of numerous design improvements will result in large-system equipment which can produce electric power at a cost effective rate.

Project status

System specifications are being completed for distribution prior to a competitive procurement.

Project schedule (provisional)

Congressional authorization, fiscal year 1981.
Design start, January 1981.
Construction start, October 1982.
Operation start, October 1983.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	2.5		2.5
Anticipated fiscal year 1982			([1])

[1] To be determined.

PROJECT 81–H–09 SIX ADDITIONAL ADVANCED MEDIUM SCALE WIND TURBINES (MOD–6), VARIOUS LOCATIONS TO BE DETERMINED

Fiscal Year 1981 authorization	$3, 000, 000
Total estimated cost	9, 000, 000
Total estimated cost increase since inception	none

Purpose

To demonstrate multiple installations of both vertical and horizontal axis intermediate-system wind turbines.

Facility Description

Six demonstration models, three installations of vertical axis and three of horizontal axis design, each producing electric power in the 100–1000 kw range, obtained through competitive procurement.

Process Description

The demonstrated designs will be provided by a DOE-sponsored development project and the size(s) will be in the same capacity range.

Project Status

Project Schedule (provisional)

Congressional authorization, ———.
Design start, ———.
Construction start, ———.
Operation start, ———.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Requested fiscal year 1981	3		3
Anticipated fiscal year 1982			

PROJECT 81–H–10 SIX ADDITIONAL ADVANCED MULTI-MEGAWATT WIND TURBINES (MOD–5), VARIOUS LOCATIONS TO BE DETERMINED

Fiscal year 1981 authorization	$5,000,000
Total estimated cost	15,000,000
Total estimated cost increase since inception	None

Purpose

To demonstrate multiple installations of advanced large-scale wind turbines.

Facility Description

Six demonstration models, three installations of two different designs, each providing electric power in excess of 1 MW, obtained through competitive procurement.

Process Description

The demonstrated designs will be provided by DOE-sponsored development projects and the size(s) will be in the same capacity range.

Project Status Design effort is concurrent with the first and second advanced multimegawatt wind turbines.

FINANCIAL SCHEDULE

[In millions of dollars]

Year	Authorizations	Appropriations	Obligations
Through fiscal year 1980	None		None
Requested fiscal year 1981	5		5
Anticipated fiscal year 1982			(1)

[1] To be determined.

5. NATURAL RESOURCES AND ENVIRONMENT

The Subcommittee on Natural Resources and Environment has jurisdiction over environmental and biomedical research, development and demonstration construction projects. The Subcommittee also has jurisdiction over projects in the areas of general life sciences and nuclear medicine applications.

The total amount authorized for construction work (plant and capital) for Fiscal Year 1981 was:

	Thousands
Biological/environmental research	$6,400

FISCAL YEAR 1981—DEPARTMENT OF ENERGY AUTHORIZATION

SUBCOMMITTEE ON NATURAL RESOURCES AND ENVIRONMENT

[In thousands of dollars]

	Construction expenses						
Project No. and description	Total estimated cost	Previous authorization	Fiscal year 1981 DOE authorization request	1981 revised DOE request	Variation from budget	Amount authorized	Total authorization through fiscal year 1981
81-E-305—General plant projects for environmental research and development facilities, various locations	3,000	0	3,000	3,000	0	3,000	3,000
81-E-306—Modifications and additions to biomedical and environmental research facilities, various locations	3,400	0	3,400	3,400	0	3,400	3,400

PROJECT NO. 81-E-305—GENERAL PLANT PROJECTS, VARIOUS LOCATIONS

Fiscal year 1981 authorization	**$3,000,000**
Total estimated cost	**3,000,000**

Purpose

This estimate is for minor new construction and other capital alterations, additions, and retirements to land, buildings, and utilities systems. The estimate also includes the cost of installed equipment which is an integral part of the general plant subprojects.

Facility Description

Although it is difficult to detail this type project in advance, there are several subprojects under consideration. In general, the estimated costs for each of the subprojects are preliminary in nature and primarily indicative of the size of the project. The continuing review of DOE requirements will result in some of the projects being changed in scope; it will also result in other projects being added to the list with the necessary postponement of some now listed, all depending on conditions or situations not apparent at this time. These general plant projects will provide facilities for conducting critical research programs, contribute to greater efficiency, eliminate health and safety hazards, and will reduce maintenance and operational costs.

Project Status (April 1980)

This project is a new start for fiscal year 1981.

PROJECT NO. 81-E-306—MODIFICATIONS AND ADDITIONS TO BIOMEDICAL AND ENVIRONMENTAL RESEARCH FACILITIES, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$3,400,000
Total estimated cost	3,400,000

Purpose

Expansion of the Biological and Environmental Research program requires facilities to assure that the various technologies under development for the increased production of energy can be implemented effectively in pursuit of the national goal of self-sufficiency in energy and assure a healthy and safe environment. No significant R&D program is anticipated as a prerequisite for design and construction of these projects.

Facility Description

This project primarily covers modifications and additions to existing facilities at two of the biomedical and environmental laboratories.

The projects considered to be of highest priority identified for funding in FY 1981 are as follows:

(*a*) Biomedical laboratory addition, Lawrence Berkeley Laboratory, California ($1,400): The proposed addition will be about 8,600 gross square feet and will be comprised of two parts. The first consists of completing an unfinished first story under the existing second story wing, and adding a third story wing. The second part consists of adding a new single story wing at the second floor level. The principal building materials will be structural steel reinforced concrete. New air handling equipment will be provided for the addition as well as emergency power capacity. All other utilities will be extended from the existing building.

(*b*) Modernization of laboratories for study of environmental pollutants, Oak Ridge National Laboratory, Tennessee ($2,000): This project involves the upgrading of existing air supply and exhaust systems and the renovation of approximately 2,000 square feet in selected portions of an existing building. The existing air conditioning supply systems will be modified to provide adequate quantities of clean air to laboratory and animal facilities. The exhaust systems for the laboratory areas and animal areas will be upgraded to provide adequate treatment and filtration of exhaust air to remove pollutant materials. Selected areas will be renovated to provide clean-room type facilities.

Project Status (April 1980)

This project is a new start for fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	3.4	3.4	3.4

6. DEPARTMENTAL PROJECTS

The Committee shares jurisdiction over plant and capital projects involving certain modifications which can result in appreciable energy savings at various plants.

Additionally, the Committee shares jurisdiction over planning and design for future plant and capital projects.

	Thousands
Energy modifications	$58, 800
Planning and design	9, 000
Total	$67, 800

FISCAL YEAR 1981—DEPARTMENT OF ENERGY

AUTHORIZATION

DEPARTMENTAL PROJECTS

[In thousands of dollars]

Project No. and description	Total estimated cost	Previous authorization	Fiscal year 1981 DOE request	1981 revised DOE request	Variance from budget	Amount authorized	Total authorized through fiscal year 1981
DEPARTMENTAL ADMINISTRATION							
In-house Energy management							
81-A-601—Modifications for Energy Management, various locations	28, 200	0	28, 200	NC	0	28, 200	28, 200
81-A-602—Energy Monitoring and Control System, Y-12 Plant, Oak Ridge, Tenn	5, 000	0	5, 000	NC	0	5, 000	5, 000
81-A-603—Energy Monitoring and Control System, Oak Ridge, National Lab, Tenn	4, 000	0	4, 000	NC	0	4, 000	4, 000
81-A-604—HVAC Heat Recovery and Night Setback, Richland, Wash	3, 000	0	3, 000	NC	0	3, 000	3, 000
81-A-605—Automated Energy Management System, Argonne National Lab, Ill	3, 800	0	3, 800	NC	0	3, 800	3, 800
80-DA-6—Alternate Energy Source, Pantex Plant, Amarillo	46, 600	3, 300	43, 300	NC	−31, 000	12, 300	15, 600
OTHER SUPPORTING ACTIVITIES							
81-H-11—Barnwell Nuclear Fuel Plant, Barnwell S.C.	(1)	0	0	0	+2, 500	2, 500	2, 500
81-C-601—Plant Engineering and Design, various locations	9, 000	0	9, 000	NC	0	9, 000	9, 000
Total, other supporting activities					28, 500	67, 800	

[1] Undetermined.

PROJECT NO. 81-A-601—MODIFICATIONS FOR ENERGY MANAGEMENT, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$28, 200, 000
Total estimated cost	28, 200, 000

Purpose

These energy modifications will be accomplished for the sole purpose of saving energy. Projects will be selected on the basis of economics and energy saved per dollar invested. Only those projects with a relatively quick payback will be selected and funded.

Facility Description

This project is for various small retrofit projects to reduce energy consumption. These small modifications have been selected on the basis of energy saved per investment dollar, total dollar return on investment, and quickness of payback. Projects compete on a DOE-wide basis for funding under this lump sum item thus assuring the greatest economic return and greatest energy savings per investment dollar for the Department.

Project Status (April 1980)

This project is a new start for fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligation
1981	28.2	28.2	28.2

PROJECT NO. 81–A–602—ENERGY MONITORING AND CONTROL SYSTEM, Y–12 PLANT, OAK RIDGE, TENN.

Fiscal year 1981 authorization	$5,000,000
Total estimated cost	5,000,000

Purpose

This project is directed toward compliance with Executive Order 12003 and will effect significant savings. It is estimated that an energy savings of $1,770,000 per year and an operating savings of $160,000 per year (fiscal year 1978 dollars) will be achieved.

Facility description

This project is the initial phase involving the installation of a plant-wide energy monitoring and control system (EMCS). Phase I encompasses approximately 20 percent of the buildings in the Y–12 area. Future phases will increase the capability, coverage, and energy savings attainable with an energy management system.

This EMCS project provides for systematic management of energy consumption consisting of a centralized monitoring and control system for heating, ventilating, and air conditioning (HVAC) including but not necessarily limited to systems in sixteen (16) buildings throughout the Oak Ridge Y–12 Plant. Approximately 2,800 monitoring and control points are anticipated. The proposed system will monitor temperatures, pressures, and humidities and provide for optimizing the start-stop operation on a programmed basis.

The control console, consisting of a mini-computer, high-speed line printer, CRT console, systems display console, keyboards, and paper tape reader, will be located in the present Plant Shift Superintendent's (PSS) office. This equipment will be capable of monitoring and controlling energy consuming systems and of analyzing, printing, and displaying information to be used in the management and administrative control over the system's operations.

Various electrical, pneumatic, and mechanical devices will be installed throughout the buildings to provide for the programmed start-stop of HVAC systems together with sensors to monitor air temperature, humidity, air flow indication, and filter bank differential pressure.

Modifications to the PSS office will consist of relocating existing equipment, providing a raised floor, and a building addition of approximately 800 square feet. The existing HVAC system will be supplemented to provide controlled environment for the new addition.

Project status (April 1980)

This project is a new start in fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	5	5	0.5
1982			4.5

PROJECT NO. 81–A–603—ENERGY MONITORING AND CONTROL SYSTEM, OAK RIDGE NATIONAL LABORATORY

Fiscal year 1981 authorization	**$4,000,000**
Total estimated cost	**4,000,000**

Purpose

Most of the facilities at ORNL were installed before the national commitment to energy conservation, when design objectives stressed low capital investment with little value given to low energy usage. Under these guidelines, many HVAC systems at ORNL were equipped with controls which provide for continuous operation 24 hours per day regardless of occupancy. As many areas are occupied only 40 hours each week, shutting down or minimizing requirements of unneeded equipment with an automated control system during off-hours and weekends makes possible significant reduction in energy costs. A major savings will result from a monitoring system which will indicate where energy is wasted and will result in administrative action which will correct the situation.

Facility Description

This project provides an Energy Monitoring and Control System (EMCS) for centralized monitoring and control of, but not necessarily limited to, a portion of the Central Research and Administration Building, a portion of the High Level Radiochemical Laboratory, the Cafeteria, and the Metals and Ceramics Building. This system will perform the function of HVAC System monitoring and controlling. Properties to be monitored and/or controlled will be temperature, pressure, humidity, flow and equipment start-stop status. About 3,000 points and eight buildings are expected to be included.

Devices required for computer-controlled, start-stop/status will be installed on the HVAC equipment located in five buildings. Sensors will be included to monitor air temperatures, humidity, filter differential pressure, air flow indication and damper position. All necessary wiring, conduit, junction boxes, remote panels, etc., will be included for a complete functional system.

Modifications in the Central Research and Administration Building will include installing motorized dampers in hood exhaust ductwork and supply units, backdraft dampers in grille exhaust ductwork, switches on hood sashes, and blanking covers over laboratory type hood bypasses. In addition, all sensors and controls necessary to effect supply air reset on all oncethrough HVAC units will be installed.

Modification to the Metals and Ceramics Building will provide for reduction of air flows by 50 percent when the building is unoccupied. A combination of in-place sensors, computer software and two speed motors will allow this reduction in airflow with commensurate energy savings without loss of safety.

Project Status (April 1980)

This project is a new start in fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	4	4	4

PROJECT NO. 81–A–604–HVAC HEAT RECOVERY AND NIGHT SETBACK, RICHLAND, WASH.

Fiscal year 1981 authorization	$3,000,000
Total estimated cost	3,000,000

Purpose

Since most HVAC systems for the heat recovery buildings identified are one-pass systems with high ventilation rates, significant amounts of heat are exhausted to the atmosphere in the winter. It is proposed to recover the wasted heat to preheat the building make-up air and reuse the conditioned air by recirculating the air where feasible. Run-around heat recovery systems are used in areas where there is a potential for radioactive airborne contamination thus eliminating the potential for introducing contamination into an occupied area. Due to the cold climate in the Richland, Washington region (5,267 heating degree days), approximately 0.151 million Btu/cfm-yr. can be recovered from building exhaust. This heat is mainly supplied through steam generated by oil and coal at central plants. A savings of roughly 12 percent in the total heating load for these buildings is anticipated. This project is estimated to save 146,000 MBtu of steam per year. Since the present cost of steam is $4.50 per MBtu, the total first year savings will be $657,000.

Facility Description

This project will modify the HVAC systems of selected candidate buildings to reduce energy use, conserve scarce fuel supplies and reduce energy costs on the Hanford Reservation through use of various heat recovery techniques and recirculation of clean air. It will also utilize night setback thermostats in the buildings to reduce heat loss during the off-shift hours. As currently conceived, the project is divided into candidate HVAC system modification subprojects, each showing the most potential for energy conservation and the ability to be modified without disrupting normal operations of the facility. Twelve specific heat recovery subprojects have been identified at this time for performance of conceptual design.

Other facilities are available that lend themselves to the same type of savings and are considered as part of this project to the extent they can be completed within the total estimated cost. The twelve specific subprojects listed below are subject to change depending on the identification of other subprojects showing better results based on economic analysis. Other technologies will also be considered (e.g., solar, wind, thermal storage, etc.) that may be incorporated into the facility processes to increase energy conservation and improve the economic payback periods.

Project Status (April 1980)

This project is a new start for fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authori ations	Appropriations	Obligations
1981	3	3	3

PROJECT NO. 81–A–605—AUTOMATED ENERGY MANAGEMENT SYSTEM, ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.

Fiscal year 1981 authorization	$3, 800, 000
Total estimated cost	3, 800, 000

Purpose

This project is justified by the potentially large savings which can be realized by the centralized control of numerous systems which are currently independently and inefficiently controlled. The initial installation will coordinate the systems of about 37 buidings, including the central heating plant. Expansion capability for additional buildings will be provided without the requirement for major system modification.

Facility Description

This project includes a complete system for monitoring and controlling the physical plant systems, such as heating, ventilating and air conditioning, with sensors of various types located at the points to be monitored. The action of the sensors will be transmitted to a central location which will have the capability of issuing commands to make necessary on-line adjustments to various system parameters with response occurring immediately; a combination of hardware and software will permit simultaneous data processing, output printing and operator communication. Through its central computerized control, the system will start and stop fans based on inside/outside conditions, adjust air stream temperature to provide the most economic enthalpy control for heating and cooling, survey supply and return temperature differentials to adjust loading and unloading of chillers, and improve damper operation to meet minimum leakage requirements. The system initially will comprise 5,500 points (including both sensors and final control elements) and will be expandable to 10,000 points without additional computer module or extensive system modifications.

The following items will be located at the fully computerized central location: Central processing unit(s) with bulk memory storage capacity; full cathode ray tube display with alpha/numeric keyboard entry; a graphic projector; a line printer; an alpha/numeric keyboard printer for input/output functions and any additional items required for the subsystems. Loop remote terminals at all major buildings and facilities on the site will be linked by coaxial cable and external pairs of wires as required. Remote inputs will be linked by single pair wires.

The immediate, and primary, purpose of the system is to conserve energy, but it will have inherent capability for security, maintenance and other uses to reduce manpower levels and assure reliability.

Project Status (April 1980)

This project is a new start for fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	3.8	3.8	3.8

PROJECT NO. 80–DA–6 ALTERNATE ENERGY SOURCE, PANTEX PLANT, AMARILLO, TEX.

Fiscal year 1981 authorization	$12,300,000
Total estimated cost	46,600,000

Purpose

The purpose of this project is to reduce the use of natural gas at the Pantex Plant by replacing the 28-year-old natural gas-fired steam plant and steam distribution system with a modern coal burning steam plant and hot water distribution system.

In consonance with the Power Plant and Industrial Fuels Use Act of 1978, the Department of Energy plans as aggressive fuel conversion program covering both Federal and private facilities. As part of the Department's actions to implement the Act, orders will be issued prohibiting consumption of fuel oil and natural gas to new installations with boiler capacities similar to those of the Pantex Plant. The conversion program is being initiated at this time as part of DOE policy to reduce its use of fuel oil and natural gas. It is appropriate to proceed with conversion of the Pantex Plant due to the age and poor condition of the existing facilities. Both the existing boiler plant and the existing steam distribution systems are near the end of their design life and are in need of repair.

Engineering studies have evaluated in detail the five most realistic applications for alternate fuel options at the Pantex Plant. These include:

1. Coal-fired steam plant with steam distribution system;
2. Coal-fired steam plant with hot water distribution system;
3. Coal-fired steam plant with steam distribution system and cogeneration of electricity;
4. Coal-fired steam plant with hot water distribution system and cogeneration of electricity;
5. All electric power for heating, cooling, and process needs.

Life cycle cost analyses showed that extensive use of electric power at the Pantex Plant would result in highest fuel costs and the poorest payback potential. These findings are consistent with DOE policy and the National Energy Act which discourages the use of electricity for electric resistance heating. The studies showed that a coal-fired steam plant with a hot water distribution system and cogeneration would be the most economical alternate fuel option. The facilities to be provided by the construction project described in this budget request are economically justified on the basis of a 20 year life cycle cost analysis. The main reason for the lower life cycle cost of the proposed cogeneration plant is that coal is lower in cost than natural gas on a BTU basis. The turbine generators included in this project are sized to produce maximum power from steam which is used to satisfy the Plant's thermal demand. The resultant reduction in costs for outside electrical power contributes to the lower life cycle costs of this project.

The life cycle cost comparison shows that this project will produce an annual cost saving of $5.5 million and will payback in 14.5 years. Over 248 billion BTUs of energy will be saved annually and more than 540 million cubic feet of natural gas will not be used. By comparison with the existing facilities, total operating costs at the Pantex Plant for energy (electricity, fuel and applicable maintenance materials and personnel costs) using the proposed project is approximately $3,440,000 per year versus current costs of $5,250,000 per year. The difference in costs is almost entirely in the cost of fuel and purchased electric power.

Facility Description

This project will provide a new coal fired steam plant and a new underground hot water distribution system to supply the building heating requirements of the Pantex Plant, near Amarillo, Texas. This project will replace the 28-year-old natural gas-fired steam plant and distribution system. The new plant will be designed to burn low sulfur coal and will include provision for cogeneration of 4,000 kilowatts of electric power to offset outside power requirements. The new steam plant will be centrally located between major heating and cooling loads on the site.

Improvements to land will consist of a new railroad spur, approximately 5,800 feet long, a railroad car unloading facility, paving of access and parking, and a fire protection system will be provided as a part of the site development. An ash yard, approximately 300 feet long and 100 feet wide will be located adjacent to the coal storage area.

A new building will be built to house the boilers and associated equipment. The building will be a steel frame structure approximately 150 feet long, 100 feet wide and 60 feet high. The walls will be of insulated metal siding. The boiler plant will consist of three high pressure steam boilers rated at 40,000 pounds per hour each and two turbine generators rated at 2,000 kw each. Adjacent to the boiler house will be a 7′ diameter, 140 foot high stack.

Equipment to be provided by this project, in addition to the boilers and generators, will include the necessary boiler auxiliary equipment such as de-areators, pumps, and heat exchangers. Coal handling equipment will include a rail car unloader and conveyor to the boiler house. Conveyors will also be provided to handle ash. Particulate emission control equipment will be provided to meet air pollution control requirements. Equipment associated with the hot water distribution system will include pumps and instrumentation. Some existing steam absorption chillers and dehumidification equipment will be modified and reused.

Special facilities included in this project include construction necessary to modify 123 existing buildings which presently use steam for heating, cooling, and dehumidification, or which use natural gas combustors for direct heating. Existing equipment and piping will be modified where possible to use hot water from a new underground distribution system.

Utilities to be provided include connections between the existing power distribution system and the new generators. Electric power will be produced at 4,160 volts, stepped up to 12,470 volts, and tied into the primary feeders to the main weapon production areas. The connection from the generator to the main feeder will be made through an oil circuit breaker. Utilities also include the new hot water system that will distribute 265 degree F water for heating and cooling. Approximately 33,000 feet of underground insulated piping will be installed. Man holes and valves will be installed. New hot water piping will be installed in existing buildings to connect both new and modified heating and cooling equipment. A new water well will be located at the plant site and will be connected to appropriate treatment and a demineralization water storage tank will be provided. A sanitary sewer will be installed to connect with the existing sanitary system serving the site.

The existing above ground steam distribution system and the steam piping in existing buildings will be dismantled and removed.

Project Status (April 1980)

The project is in the engineering phase (Title I). Construction work has not been started.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1980	3.3	3.3	1.8
1981	12.3	9.0	10.5
1982	30.0	34.3	33.65
1983			.65

PROJECT 81-H-11, BARNWELL NUCLEAR FUEL PLANT, BARNWELL, S.C.

Fiscal year 1981 authorization	$2, 500, 000
Total estimated cost	Undetermined

Purpose

To provide for the Secretary of the Department of Energy to enter into negotiations with the owners of the plant for the purpose of purchasing it, leaving it or condemning it.

Facility Description

The facility consists of land, utilities, roads, grounds, buildings, offices, machinery, equipment, controls, storage areas, security provisions and related appurtenances.

Project Status

The facilities are approximately 90 percent complete.

PROJECT NO. 81-C-601, PLANT ENGINEERING AND DESIGN, VARIOUS LOCATIONS

Fiscal year 1981 authorization	$9, 000, 000
Total estimated cost	9, 000, 000

Purpose

Conceptual studies completed for a project, utilizing operating funds, define the scope of the project and produce a rough cost estimate. These conceptual design studies are completed 9 to 12 months before the budget is submitted to the Congress, resulting in the studies being as much as 24 months old by the time authorizing legislation is enacted. The use of this project funding to proceed immediately upon completion of conceptual design into Architect-Engineering designs would permit acceleration of new facilities, provide savings in construction costs based on current rates of inflation, and would permit much more reliable cost estimates being available to the Congress when the budget is presented.

Facility Description

This project provides for Architect-Engineering services (Title I and Title II) on Departmental construction project (excluding those authorized under Atomic Energy Defense) which the DOE has under consideration for authorization request in future years. Prior to being considered for Congressional authorization, this will allow certain designated projects to proceed from conceptual design into Preliminary design (Title I) and Definitive Design (Title II). Design efforts accomplished under this project will be sufficient to assure project feasibility, define the scope, provide detailed estimates of the cost of construction based on the approved design and working drawings and specifications, and provide construction schedules, including procurements. Designs will generally be extensive enough so that construction can physically start or contracts be let for long-lead procurement items in the budget fiscal year in which Congressional authorization is sought. Engineering deisgn accomplished under this project may encompass the design requirements of any construction project except (1) design required for small construction projects whose total estimated cost is less than $1,000,000 included in the General Plan Project funding request, (2) projects to be authorized under Atomic Energy Defense Activities, and (3) conceptual design accomplished with operating funds.

Project Status (April 1980)

This project is a new start in fiscal year 1981.

FINANCIAL SCHEDULE

[In millions of dollars]

Fiscal year	Authorizations	Appropriations	Obligations
1981	9	9	9

N. Other Committee Actions

1. DEPARTMENTAL ADMINISTRATION

[In thousands of dollars]

	Fiscal year 1980 budget authority estimate	Fiscal year 1981 DOE authorization request	Revised fiscal year 1981 DOE authorization request[1]	Committee action	
				Changes to original authorization request	Total authorization
OPERATING EXPENSES AND CAPITAL EQUIPMENT					
Policy analysis and systems studies	16,500	19,600	−1,000	−5,400	14,200
International affairs:					
International cooperation in nonnuclear technologies	2,000	3,600	−100	−100	3,500
International policy studies	1,500	1,500	−900	−900	600
Total, international affairs, operating	3,500	5,100	−1,000	−1,000	4,100
Management and support:					
Salaries and expenses[2]	[2] 154,383	172,074		−2,500	169,574
SES rank and performance awards	0	2,727			2,727
Travel	5,576	6,054			6,054
Support services	86,906	103,610	−5,000	−5,000	98,610
Financial assistance	3,000	3,200			3,200
Subtotal, operating	249,865	287,665	−5,000	−7,500	280,165
Capital equipment	4,305	4,600			4,600
Total, management and support	254,170	292,265	−5,000	−7,500	284,765
Intergovernmental and institutional relations:					
Technical information services	10,574	11,708			
Education, business, industry and labor affairs	7,200	9,700			
Intergovernmental affairs	8,672	9,835			
Consumer affairs	535	1,200			
Public affairs	2,015	3,200			
Indian affairs	750	1,100			
Subtotal, operating	29,746	36,743		−2,500	34,243
Capital equipment	510	565			565
Total, intergovernmental and institutional relations	30,256	37,308		−2,500	34,808
In-house energy management	3,600	3,900			3,900
Security investigations	16,400	17,012	−2,000	−2,000	15,012
Cost of work for others:					
Cost of products sold	10,229	12,444			12,444
Cost of services performed	14,765	31,359			31,359
Total cost of work for others, operating	24,994	43,803			43,803
Miscellaneous revenues (applied to budget authority):					
Revenues from products sold	−11,400	−16,945			
Revenues from services performed	−15,370	−34,046			
Other	−94,890	−80,276			
Total, miscellaneous revenues, operating	−121,660	−131,267			
Changes in inventory	16,260	12,000			12,000
Total, departmental administration, operating, and capital equipment	229,020	430,988	−9,000	−18,400	412,588
SUMMARY					
Operating expenses	224,205	425,823	−9,000	−18,400	407,423
Capital equipment	4,815	5,165			5,165
Construction authorization		96,300		−31,000	65,300
Construction budget authority	31,200	62,000			62,000
Total authorization		527,288		−49,400	477,888
Total budget authority	260,220	492,988	−9,000	−18,400	474,588

[1] Indicates changes to original fiscal year 1981 budget authority request.

[2] Excludes pending supplemental of $3,383,000 for 44 additional positions and $5,996,000 for October 1979 pay raise.

COMMITTEE VIEW

The Department shall disburse the community assistance payments authorized by this section to the communities in a timely and orderly fashion and shall notify the Committees of Jurisdiction at the start of the fiscal year of the approximate schedule for this disbursement.

COMMITTEE ACTION

The Committee decreased operating expenses for five Departmental Administration programs. The total reduction in operating expenses is $18.4 million.

The Committee reduced the Policy Analysis and Systems Studies operating expenses by a total of $5.4 million. The Energy Research and Production Subcommittee reduction of $1 million was in line with the Administration's amended budget request. The remaining $4.4 million reduction was a result of the following Committee concerns regarding:

(1) The number of personnel under the Assistant Secretary for Policy and Evaluation (196 full-time)

(2) The precise nature of the role of P&E in the DOE reorganization, since the Secretary in office has additional policy staff and the Assistant Secretaries are performing many policy studies appropriate to their technologies (e.g. Conservation & Solar Applications study "DOE Solar Energy Observations, 1980.")

(3) The need for P&E to conduct independent studies and analysis rather than simple review in order to fulfill their role as an "honest broker" in the DOE. Certain of the studies (e.g. waste management) planned for FY 1981 are not priority items in the Committee view.

(4) The extensive role of P&E in the budgetary and planning cycle which raises the related issue of the role of the Controller's organization and its resource requirements in the overall DOE headquarters organization.

(5) The level of outside contracting which raises questions as to the quality and breadth of in-house competence of the P&E organization.

The Committee reduced International Affairs by a total of $1.0 million in accordance with the Administration's revised budget request. This decrease includes a reduction of $0.1 in International Cooperation in Non-Nuclear Technologies. The reduction will delay the start of one country energy assessment. The decrease also includes a reduction of $0.9 million in International Policy Studies. This reduction will reduce the number of international policy studies undertaken in fiscal year 1981.

The Committee reduced Management and Support by a total of $7.5 million. This decrease includes a reduction in salaries and expenses of $2.5 million, which still allows for more than 10 percent growth in funding over fiscal year 1980. The decrease also includes a reduction of $5 million in support services, in accordance with the Administration's revised budget request.

The Committee reduced Intergovernmental and Institutional Relations by $2.5 million. This action permits the Intergovernmental and Institutional Relations budget of the Department to increase from $30,256,000 to $34,243,000 rather than permitting a 23-percent increase in these programs, which are ancillary to the Department's main mission. The Department is directed to take a hard look at new initiatives and programs with large one-year increases where deferral of program expansion can be achieved.

It is not the intent of this action to reduce the Inventors Program or the Community Assistance programs which serve very important functions and are virtually level funded.

The Committee reduced Security Investigations by $2 million in accordance with the Administration's revised budget request. The decrease will reduce the number of full field investigations for security clearances by 500.

The Committee decreased construction authorization for one In-House Energy Management project, Project 80–DA–6, Alternate Energy Source, Pantex Plant, Amarillo, Texas, by $31 million. DOE had requested a fiscal year 1981 authorization of $43.4 million. The recommended authorization of $12.3 million will meet all project obligations through fiscal year 1981. (The recommended budget authority for fiscal year 1981 was left unchanged at $9 million).

O. General Provisions: Section-by-Section Analysis

TITLE VIII—THE GENERAL PROVISIONS

The Committee has adopted General Provisions in Title VIII for the Department of Energy's FY 1981 Authorizations for civilian programs. These provisions are intended to supercede the provisions of Section 111 of the Energy Reorganization Act of 1974 which applied generally to annual authorization bills. A section by section explanation of Title VIII general provisions follows:

Section 801(A) limits the reprogramming of funds, except for Title I and Title VI, unless notice is given to the appropriate committees of the House and the Senate containing a full and complete statement of the actions proposed to be taken. Such notice must be provided 30 days before any action is taken unless each committee before the expiration of such period has given written notice that it has no objection to the proposed action.

Sectoin 801(B) applies this provision to any office or unit of the Department of Energy.

Section 801(C) requires the Department to report to the appropriate authorizing committees their reasons for any reprogramming of funds pursuant to this section.

Section 801(D)(1) specifies reprogramming provisions for Titles I and VI of this bill which limits (a) reprogramming in excess of amounts expressly authorized, and (b) the use of any appropriated funds for any project which has not been presented to or requested by the Congress; unless the 30 day notice is given to the appropriate committees of the House or the Senate.

Section 801(D)(2) limits the reprogramming of funds to specific sections of this bill which may not be decreased by more than 10%.

Section 802 allows revenues received by the Department in providing uranium enrichment services to be retained and used solely for the purpose of offsetting any cost incurred by the Department in conducting that activity irrespective of the provisions of Section 3617 of the Revised Statutes. In addition, any appropriated funds for the same purpose shall be reduced by the amount of revenues received during that fiscal year.

Section 802(B) provides that receipts of the Secretary and the Commission including any payment received because of overcharges by persons under the jurisdiction of the Secretary of the Commission must be deposited in the Treasury of the United States as miscellaneous receipts.

Section 802(C) prohibits reprogramming of uranium enrichment revenues.

Section 802(D) exempts power marketing functions of the Department from this section.

Section 802(E) provides that Subsection (h) of Section 111 of the Energy Reorganization Act shall not apply to this section.

Section 803 allows unexpended balances of any appropriations to the Department for operating expenses, plant and capital equipment, or any other program to be transferred to a new appropriations account established for the same purposes and merged with funds in the new account creating one fund for the same period as originally enacted. The only limitation is that appropriated funds for plant and capital equipment may not be merged with amounts appropriated for operating expenses. Moreover, the Secretary of Energy must report such transferred balances to the appropriate committees within 30 days.

Section 804 allows authorized appropriations for salary, pay, retirement, or other benefits for Federal employees to be increased by such amounts as may be necessary for increases allowed under law.

Section 805 limits the authority to enter into contracts obligating the United States to make outlays only to the extent as may be provided in the appropriations acts.

Section 806 specifies that this act shall not apply for any military application of nuclear energy, for research and development and support of armed services, or for the common defense and security of the United States. In addition, it defines the terms "military application", "research and development", and "common defense and security".

Section 807 allows the Department to transfer funds appropriated pursuant to the act to other agencies for performance for work for which the appropriations was made.

Section 808 limits the use of operating expenses for research, development and demonstration programs pursuant to Titles VI and VII for the acquisition of land or for any item of equipment, if the estimated cost of the Federal government exceeds $2 million, unless previously authorized, until such action is in accordance with Section 808 (C).

Section 808(B) allows the Secretary to use up to 1 percent of all funds appropriated pursuant to the authorizations in Titles I, VI and VII for operating expenses to be used by the Secretary to construct, expand, modify or acquire any facilities including laboratories for major items of equipment, or to acquire land at the location under the control of the Secretary, if the Secretary determines in writing that (a) such action would be necessary on account of changes in the national programs previously authorized or because of new scientific and engineering developments, and (b) deferral of such action would be inconsistent with the policies of the Congress, and in the case of any project the estimated costs of which exceeds $50,000, such determination must be made in accordance with Section 808(C).

Section 808(C) specifies that such actions described above are subject to the submission by the Secretary of a written report containing a full and complete statement concerning the proposed actions to the appropriate of the House and Senate for 30 days before any such action can be taken, unless the Secretary receives a written notice from each committee that each has no objection to the proposed action.

Section 809 provides that the authorization in this act expire after three years if funds are not appropriated for the authorized activities or the Congress does not extend the authorization.

Section 810 states that the provisions of this title shall supercede the provisions of Section 111 of the Energy Reorganization Act of 1974.

V. COMMITTEE RECOMMENDATIONS

In compliance with clause 2(1)(2)(B) of rule XI of the Rules of the House of Representatives, the bill was ordered reported by the Committee on Science and Technology on May 8, 1980, by a recorded vote of 39–1 a quorum being present.

VI. COST AND BUDGET DATA

The bill authorizes appropriations for fiscal year 1981 in the amount of $7,005,000,000 net in new obligational authority.

Pursuant to rule XIII, clause 7, the Committee has made the following cost estimate for H.R. 6627 for the duration of the authorizations contained therein for fiscal year 1981 (no costs will be incurred for the fiscal year 1980).

Net estimated authorization level (FY 1981) $5,724,000,000.

Net estimated outlays:

Fiscal year:	
1981	$2,769,000,000
1982	1,894,000,000
1983	955,000,000
1984	106,000,000
1985	------------

VII. EFFECT OF LEGISLATION ON INFLATION

In accordance with Rule XI, Clause 2(1)(4) of the Rules of the House of Representatives, this legislation is assessed to have a minimal inflationary effect on prices and costs in the operation of the national economy.

This bill represents a substantial part of the total Department of Energy budget but its inflationary impact must be seen in light of the total.

Since non-weapons DOE activities are conducted mainly by hundreds of contractors, colleges, and universities located throughout the United States and representing various segments of the economy, it is estimated that the increased fiscal year 1981 DOE outlays would not have a significant inflationary impact on any one particular segment of the economy. Since the capacity of the nation's scientific research and development institutions is not fully utilized, the funds provided under this bill would not materially contribute to competitive pressures for manpower and materials which might contribute to inflation. Further, the results of energy R&D supported by DOE should contribute to the development of new technologies which should help productivity.

VIII. CHANGES IN EXISTING LAW

Changes in Existing Law Made by the Bill, As Reported

In compliance with clause 3 of Rule XIII of the Rules of the House of Representatives, there are no changes in existing law made by the bill, as reported.

IX. COST ESTIMATE, AND COMPARISON. CONGRESSIONAL BUDGET OFFICE

CONGRESSIONAL BUDGET OFFICE—COST ESTIMATE

May 15, 1980.

1. Bill number: Titles I, VI, VII, and VIII of H.R. 6627.

2. Bill title: Department of Energy Civilian Programs 1981 Authorization Act.

3. Bill status: As ordered reported by the House Committee on Science and Technology, May 8, 1980.

4. Bill purpose: This bill authorizes $7,005 million for certain civilian programs of the Department of Energy for fiscal year 1981. These programs include solar, nuclear, and fossil energy research and development, as well as uranium enrichment. Receipts from uranium enrichment activities authorized by the bill result in a net authorization of $5,716 based on estimated collections of $1,289 million in fiscal year 1981. The bill also deauthorizes a total of $121.6 million for fossil energy and uranium enrichment projects previously authorized.

5. Cost estimate:

[By fiscal year, in millions of dollars]

	1981	1982	1983	1984	1985
Estimated authorization level:[1]					
Title I	5,210				
Title VI	215				
Title VII	291				
Title VIII	8				
Total	5,724				
Estimated outlays:[1]					
Title I	2,775	1,573	797	65	
Title VI	54	113	48		
Title VII	−68	208	110	41	
Title VIII	8				
Total	2,769	1,894	955	106	

[1] These figures are net of estimated uranium enrichment receipts of $1,289,000,000 in fiscal year 1981.

The costs of this bill fall within budget functions 250, 270, and 920. The function breakdown is as follows:

[By fiscal year, in millions of dollars]

	1981	1982	1983	1984	1985
Estimated authorization level:					
Function 250	552				
Function 270	5, 164				
Function 920 [1]	8				
Total	5, 724				
Estimated outlays:					
Function 250	445	72	25	10	
Function 270	2, 316	1, 822	930	96	
Function 920	8				
Total	2, 769	1, 894	955	106	

[1] Costs for pay increases authorized by sec. 804 of the bill fall within function 920 in fiscal year 1981.

6. Basis of estimate: For the purposes of this estimate, it is assumed that the entire amount authorized will be appropriated prior to fiscal year 1981. The estimated annual outlays of the major DOE programs other than uranium enrichment are based on historical spendout patterns or the spendout of comparable activities. Estimates of uranium enrichment outlays and offsetting collections are based on Department of Energy projections; these collections are assumed to substantially offset expenditures as allowed by Section 802 of the bill.

The deauthorization of $121.6 million for two existing projects is not projected to affect the fiscal year 1981 outlay estimate, as this action affects portions of previous years authorizations for which no funds have been appropriated.

Section 601 of the bill authorizes the use of $30 million of $2.2 billion appropriated in fiscal year 1980 for synthetic fuels promotion, to be used specifically to encourage heavy oil production. This is not an additional authorization and will not result in additional outlays.

In addition to the authorization levels specified in the bill, $8 million was added for fiscal year 1981 to reflect increases in pay and benefits, as authorized by Section 804 of the bill. This figure was estimated based on a 6.2 percent pay increase.

7. Estimate comparison: None.

8. Previous CBO estimate: CBO has transmitted the following cost estimates for the civilian programs of the Department of Energy, fiscal year 1981.

Bill	Committee	Date
H.R. 6627, titles II, III, V, VII, VIII	House Interstate and Foreign Commerce	May 9, 1980.
H.R. 6627, titles IV, V, VII	House Interior and Insular Affairs	May 12, 1980.

The comparable titles are similar but not identical. The estimated outlays reflect the differences.

9. Estimate prepared by: Mark Berkman.

10. Estimate approved by:

C. G. NUCKOLS,
(For James L. Blum,
Assistant Director for Budget Analysis).

X. CONGRESSIONAL BUDGET ACT INFORMATION

No information pursuant to section 308(a) of the Congressional Budget Act of 1974 has been provided to the Committee by the Congressional Budget Office. Under a separate section of this report, a five-year current programs cost estimate is provided in response to the requirement of section 403.

XI. OVERSIGHT FINDINGS AND RECOMMENDATIONS

No oversight findings and recommendations pursuant to clause 2(l)(3)(A), rule XI, under the authority of rule X, clause 2(b)(1) of the Rules of the House of Representatives are included, in addition to those comments and views contained elsewhere in this report.

COMMITTEE ON GOVERNMENT OPERATIONS

No findings or recommendations on oversight activity pursuant to clause 2(b)(2), rule X, and clause 2(l)(2)(D) of Rule XI of the Rules of the House of Representatives have been submitted by the Committee on Government Operations for inclusion in this report.

XII. DEPARTMENTAL VIEWS

DEPARTMENT OF ENERGY,
Washington, D.C., February 21, 1980.

Hon. THOMAS P. O'NEILL, Jr.,
Speaker of the House of Representatives,
Washington, D.C.

DEAR MR. SPEAKER: Enclosed is proposed legislation "to authorize appropriations to the Department of Energy for civilian programs, for fiscal year 1981 and fiscal year 1982" in accordance with section 660 of the Department of Energy Organization Act. The bill (Enclosure 1) would authorize specific appropriations for FY 1981 and those appropriations which might be necessary for FY 1982. The total amount proposed for FY 1981 is $8,732,230,000. A section-by-section analysis of the proposed legislation is also enclosed (Enclosure 2).

The Office of Management and Budget has advised that this legislative proposal is in accord with the program of the President.

Sincerely,

LYNN R. COLEMAN,
General Counsel.

Enclosures.

FISCAL YEAR 1981 DOE AUTHORIZATION BILL FOR CIVILIAN APPLICATONS

A BILL

To authorize appropriations to the Department of Energy for civilian programs for fiscal year 1981 and fiscal year 1982, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Department of Energy Authorization Act for Fiscal Years 1981 and 1982—Civilian Applications."

TITLE I—RESEARCH AND DEVELOPMENT

SEC. 101. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating and capital equipment expenses for the following fossil fuel programs:

(A) Coal, $597,071,000;
(B) Petroleum, $63,758,000; and
(C) Enhanced Gas Recovery, $30,821,000.

SEC. 102. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for fossil energy construction relating to coal, including planning, construction, acquisition, or modification of facilities, including land acquisition, as follows:

(A) Project 81–T–401, Renovation of South Wing, Building 3, Bartlesville Energy Technology Center, Oklahoma, $1,200,000;

(B) Project 81–T–402, Surplus water containment and waste water treatment facility, Pittsburgh Energy Technology Center, Pennsylvania, $1,300,000;

(C) Project 81–T–404, General plant projects, six locations, $6,000,000;

(D) Project 80–FE–3, Program support facility, Pittsburgh Energy Technology Center, Pennsylvania, an additional sum of $7,800,000 for a total project authorization of $9,500,000;

(E) Project 80–FE–10, Atmospheric fluidized bed combustion component test and integration unit, Morgantown, West Virginia, an additional sum of $9,935,000, for a total project authorization of $49,795,000;

(F) Project 80–FE–11, Pressurized fluidized bed combined cycle pilot plant, Woodridge, New Jersey, an additional sum of $9,200,000 for a total project authorization of $39,000,000;

(G) Project 79–1–R, SRC–II (Liquids) Demonstration Plant, West Virginia, an additional sum of $210,000,000 for a total project authorization of $300,000,000;

(H) Project 78–2–D, SRC–I (Solids) Demonstration Plant, Kentucky, an additional sum of $195,000,000, for a total project authorization of $275,000,000; and

(I) Project 76–1–B, High Btu synthetic pipeline gas demonstration plant, Noble County, Ohio and Perry County, Illinois, an additional sum of $193,000,000 for a total project authorization of $275,000,000.

SEC. 103. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following supply research and development programs:

(A) Solar Applications, $130,286,000;
(B) Solar Technology, $414,500,000;
(C) Geothermal, $131,179,000;
(D) Nuclear Fission, $618,847,000;
(E) Magnetic Fusion, $286,117,000;
(F) Electric Energy Systems, $38,423,000;

(G) Energy Storage Systems, $70,100,000;

(H) Hydropower, $8,211,000;

(I) Environment, $240,954,000; and

(J) Supporting Research, $274,085,000.

Sec. 104. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for supply research and development plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition; and acquisition and fabrication of capital equipment not related to construction, as follows:

(A) Solar Applications capital equipment not related to construction, $2,500,000;

(B) Solar Technology

(1) Project 81–T–305, Ethanol from biomass production/conversion system, location to be determined, $2,500,000;

(2) Project 81–T–306, Solar industrial cogeneration project, location to be determined, $1,900,000;

Project 80–B–1, Biomass thermochemical gasification experimental facility, site to be determined, an additional sum of $2,000,000, for a total project authorization of $4,000,000;

(4) Project 80–ES–2, Shenandoah solar total energy project, Shenandoah, Georgia, an additional sum of $5,800,000, for a total project authorization of $16,400,000;

(5) Project 80–ES–19, Small community solar thermal power experiment, location to be determined, an additional sum of $3,750,000, for a total project authorization of $7,545,000;

(6) Project 79–1–Q, Solar Energy Research Institute facility, Golden, Colorado, an additional sum of $10,000,000, for a total project authorization of $19,900,000;

(7) Project 76–2–B, Ten megawatt central receiver solar thermal power plant, Barstow, California, an additional sum of $10,000,000, for a total project authorization of $118,000,000; and

(8) Solar Technology capital equipment not related to construction, $14,050,000.

(C) Geothermal

(1) Project 80–G–1, Geothermal demonstration power plant project, Valles Caldera, New Mexico, an additional sum of $10,911,000, for a total project authorization of $50,340,000; and

(2) Geothermal capital equipment not related to construction, $1,310,000.

(D) Nuclear Fission

(1) Project 81–T–301, General plant projects, $2,000,000;

(2) Project 81–T–302, Salt test facility, site undetermined, $6,800,000;

(3) Project 81–T–310, General plant projects, $11,500,000;

(4) Project 80–ES–12, Near surface test facility, phase II (nuclear waste), Richland, Washington, an additional sum of $3,576,000, for a total project authorization of $11,850,000;

(5) Project 79–1–c, Security and safeguards improvements, Richland, Washington, an additional sum of $3,000,000, for a total project authorization of $12,000,000;

(6) Project 78–6–F, Fuels and materials examination facility, Richland, Washington, an additional sum of $52,000,000, for a total project authorization of $135,200,000; and

(7) Nuclear Fission capital equipment not related to construction, $30,410,000.

(E) Magnetic Fusion

(1) Project 81–T–313, General plant projects, $5,400,000;

(2) Project 80–MF–3, Elmo bumpy torus proof of principal, location to be determined, an additional sum of $34,900,000, for a total project authorization of $44,000,000;

(3) Project 80–MF–4, Large coil test facility, Oak Ridge, Tennessee, an additional sum of $6,690,000, for a total project authorization of $16,950,000;

(4) Project 78–3–B, Fusion materials irradiation test facility, Richland, Washington, an additional sum of $79,850,000, for a total project authorization of $104,250,000;

(5) Project 76–5–A, Tokamak fusion test reactor, Princeton Plasma Physics Laboratory, Plainsboro, New Jersey, an additional sum of $45,000,000, for a total project authorization of $283,600,000; and

(6) Magnetic Fusion capital equipment not related to construction, $38,100,000.

(F) Electric Energy Systems capital equipment not related to construction, $1,500,000.

(G) Energy Storage Systems capital equipment not related to construction, $1,700,000.

(H) Environment—

(1) Project 81–E–305, General plant projects, $3,000,000;

(2) Project 81–E–306, Modifications and additions to biomedical and environmental research facilities, various locations, $3,400,000; and

(3) Environment capital equipment not related to construction, $13,740,000.

(I) Supporting Research—

(1) Project 81–E–301, General plant projects, $300,000;

(2) Project 81–E–304, Accelerator improvements and modifications, Oak Ridge National Laboratory, Oak Ridge, Tennessee, $200,000;

(3) Project 81–E–308, Energy systems research laboratory (ESRL), Oak Ridge National Laboratory, Oak Ridge, Tennessee, $2,000,000;

(4) Project 81–E–309, Rehabilitation of general purpose physical plant, Argonne, Illinois, $15,100,000;

(5) Project 81–E–310, Transmission and distribution systems upgrading, Richland, Washington, $12,000,000;

(6) Project 81–E–311, Energy science and technology building expansion, Brookhaven National Laboratory, New York, $12,000,000;

(7) Project 81–E–312, Environmental and energy technology facility, Richland, Washington, $18,000,000;

(8) Project 81–E–313, Central energy conservation facility, Brookhaven National Laboratory, New York, $9,100,000;

(9) Project 81–E–314, Energy utilization improvements, Brookhaven National Laboratory, New York, $2,000,000;

(10) Project 81–E–315, Centralized cogeneration with chilled and hot water distribution, Argonne National Laboratory, Illinois, $7,400,000;

(11) Project 81–E–316, Boiler #3 replacement, Brookhaven National Laboratory, New York, $3,000,000;

(12) Project 81–E–317, Idaho National Engineering Laboratory roof replacement, Idaho, $5,300,000;

(13) Project 81–E–318, Upgrade primary substation, Oak Ridge National Laboratory, Oak Ridge, Tennessee, $3,500,000;

(14) Project 81–E–319, Install coal-fired atmospheric fluidized-bed boiler, Argonne National Laboratory, Illinois, $7,100,000;

(15) Project 81–E–320, Central supply facility, Argonne National Laboratory, Illinois, $8,500,000;

(16) Project 81–E–321, Site utilities project, Ernest Orlando Lawrence Livermore National Laboratory, California, $7,900,000;

(17) Project 81–E–322, Scoville substation distribution system upgrade, Idaho National Engineering Laboratory, Idaho, $1,000,000;

(18) Project 81–E–323, Fire safety improvements, Argonne National Laboratory, Illinois, and Idaho National Engineering Laboratory, Idaho, $4,100,000;

(19) Project 81–E–324, Fire safety and protection improvements, Idaho National Engineering Laboratory, Idaho, $3,400,000;

(20) Project 80–ES–10, Chemical and materials sciences laboratory, Lawrence Berkeley Laboratory, California, an additional sum of $6,300,000, for a total project authorization of $12,600,000; and

(21) Support research capital equipment not related to construction, $16,500,000.

Sec. 105. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses and capital equipment not related to construction for the following conservation research and development programs:

(A) Buildings and Community Systems, $64,225,000;

(B) Industrial Energy Conservation, $54,400,000;

(C) Transportation, $64,200,000; and

(D) Multi-Sector, $15,100,000.

Sec. 106. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following general science and research programs:

(A) Life Sciences Research and Nuclear Medicine Applications, $45,650,000;

(B) High Energy Physics, $242,245,000; and

(C) Nuclear Physics, $88,800,000.

SEC. 107. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for general science and research plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition; and acquisition and fabrication of capital equipment not related to construction, as follows:

(A) Life Sciences Research and Nuclear Medicine Applications capital equipment not related to construction, $2,900,000;

(B) High Energy Physics

(1) Project 81–E–218, Tevatron, Phase I, Fermi National Accelerator Laboratory, Illinois, $39,500,000;

(2) Project 81–E–219, Accelerator improvements and modifications, various locations, $6,000,000;

(3) Project 81–E–220, General plant projects, $5,000,000;

(4) Project 79–9–B, Energy saver, Fermi National Accelerator Laboratory, Batavia, Illinois, an additional sum of $19,600,000, for a total project authorization of $46,600,000;

(5) Project 78–10–B, Intersecting storage accelerator (ISABELLE) 400x400 GeV, Brookhaven National Laboratory, Upton, New York, an additional sum of $196,500,000, for a total project authorization of $275,000,000; and

(6) High Energy Physics capital equipment not related to construction, $39,000,000.

(C) Nuclear Physics

(1) Project 81–E–221, Accelerator improvements and modifications, various locations, $1,600,000;

(2) Project 81–E–222 General plant projects, $2,800,000;

(3) Project 81–E–223, Argonne tandem-linac accelerator system, Argonne National Laboratory, Illinois, $6,900,000;

(4) Project 80–GS–5, National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, Michigan, an additional sum of $24,000,000, for a total project authorization of $30,000,000; and

(5) Nuclear Physics capital equipment not related to construction, $9,400,000.

SEC. 108. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the uranium enrichment program, as follows:

(A) Uranium Enrichment Activities—Process Development operating expenses, $78,500,000; and

(B) Advanced Isotope Separation Technology, $67,299,000.

SEC. 109. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for the uranium enrichment plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition, and acquisition and fabrication of capital equipment not related to construction as follows:

(A) Project 81–T–501, Isotope research and development laboratory, New Mexico, $16,000,000;

(B) Project 81–T–502, Advanced Isotope Separation Laboratory, Ernest Orlando Lawrence Livermore National Laboratory, California, $29,700,000;

(C) Project 81–T–504, General plant projects, $2,970,000;

(D) Project 76–8–G, Enriched uranium production facilities, Portsmouth, Ohio, an additional sum of $286,325,000, for a total project authorization of $1,121,630,000; and

(E) Uranium Enrichment capital equipment not related to construction, $12,300,000.

SEC. 110. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses of the Geothermal Resources Development Fund as follows:

(A) Geothermal Resources Development Fund, $1,284,000.

TITLE II—COMMERCIALIZATION AND RELATED ACTIVITIES

SEC. 201. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the following commercialization and related activities programs:

(A) Renewable Resources—Expenses—

(1) Solar Planning, Demonstration and Distribution, $10,040,000;

(2) Solar Information Systems, $1,400,000;

(3) Hydrothermal Commercialization, $10,000,000;

(4) Hydropower, $10,789,000; and

(5) Multi-Resource, $1,036,000.

(B) Conservation Activities—Expenses—

(1) Buildings and Community Systems, $11,575,000;

(2) Transportation, $6,700,000;

(3) State and Local, $416,959,000, provided that not more than 25 percent of funds appropriated for the Schools and Hospitals Grant Program in FY 1981 may be used for purposes of technical assistance;

(4) Energy Information Campaign, $50,000,000; and

(5) Energy Impact Assistance, $150,000,000.

TITLE III—REGULATORY AND RELATED FUNCTIONS

SEC. 301. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for economic regulation as follows:

(A) to the Economic Regulatory Administration for expenses, $153,621,000; and

(B) to the Office of Hearings and Appeals for expenses, $8,850,000.

SEC. 302. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the Federal Energy Regulatory Commission as follows:

(A) Federal Energy Regulatory Commission expenses, $76,374,000.

SEC. 303. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the following energy information program:

(A) Energy Information expenses, $107,420,000.

SEC. 304. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the following strategic petroleum reserves program:

(A) Strategic Petroleum Reserve expenses, $103,978,000.

TITLE IV—POWER MARKETING AND FEDERAL LEASING

SEC. 401. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the following power marketing programs:

(A) Alaska Power Administration, including expenses for engineering and economic investigation to promote the development and utilization of the water, power, and related resources of Alaska, $3,069,000;

(B) Southeastern Power Administration, including continuing fund, $1,552,000;

(C) Southwestern Power Administration, including continuing fund, $28,208,000;

(D) Western Area Power Administration, for construction, rehabilitation, operation, and maintenance of electric power transmission facilities, and power marketing activities, $138,502,000, of which $124,200,000 shall be derived from the Department of Interior reclamation fund;

(E) Western Area Power Administration, for the Emergency Fund established pursuant to the Act of June 26, 1948 (43 U.S.C. § 502), to assure continuous operations during unsual or emergency conditions, $200,000, all of which shall be derived from the reclamation fund; and

(F) Western Area Power Administration, for continued work on the transmission system of the Upper Colorado River Storage Project, authorized by section 1(1) of the Act of April 11, 1956 (Pub. L. No. 84–485) and legislation supplementary thereto, including the Act of August 10, 1972 (Pub. L. No. 92–370), $3,548,000.

SEC. 402. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the following Federal leasing and fuel data gathering and analysis programs:

(A) Federal Leasing expenses, $3,300,000; and

(B) Fuel Data Gathering and Analysis expenses, $8,803,000.

TITLE V—NUCLEAR ASSESSMENT, SPENT NUCLEAR FUEL STORAGE AND COMMERCIAL WASTE REMEDIAL ACTION

SEC. 501. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy

Organization Act for operating expenses for the following uranium resource assessment program:

(A) Uranium Resource Assessment operating expenses, $34,455,000.

Sec. 502. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for uranium resource assessment plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition; and acquisition and fabrication of capital equipment not related to construction, as follows:

(A) Project 81-R-501, General plant projects, $800,000; and

(B) Uranium Resource Assessment—capital equipment not related to construction, $500,000.

Sec. 503. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the spent nuclear fuel storage and remedial action programs as follows:

(A) Spent Nuclear Fuel Storage expenses, $19,513,000; and

(B) Commercial Nuclear Waste Remedial Action expenses, $52,000,000.

Sec. 504. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for spent nuclear fuel storage and remedial action programs capital equipment not related to construction, $2,550,000.

TITLE VI—OTHER FOSSIL ENERGY, SOLAR ENERGY AND CONSERVATION ACTIVITIES

Sec. 601. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for expenses for the other fossil energy, solar energy and conservation activities programs as follows:

(A) Fossil Energy—Expenses
  (1) Coal, $6,191,000;
  (2) Oil and Gas Development, $8,345,000; and
  (3) Executive Direction, $551,000.
(B) Solar Energy—Expenses
  (1) Market Development and Training, $39,500,000; and
  (2) Solar International Applications, $4,000,000.
(C) Conservation Activities—Expenses
  (1) Buildings and Community Systems, $16,800,000;
  (2) Industrial Energy Conservation, $4,500,000;
  (3) Energy Management Partnership Act, $151,625,000; and
  (4) Multi-Sector, $14,100,000.

TITLE VII—OTHER DEPARTMENTAL ACTIVITIES

Sec. 701. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for the following uranium enrichment activities programs:

(A) Gaseous Diffusion Operations and Support, $825,926,000;
(B) Gas Centrifuge Operations and Support, $800,000; and
(C) Program Direction, $3,060,000.

SEC. 702. Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for uranium enrichment activities plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisiton; and acquisition and fabrication of capital equipment not related to construction as follows:

(A) Uranium Enrichment Activities—Plant and capital equipment:

(1) Project 81-R-501, General plant projects, $17,500,000;

(2) Project 81-R-502, UF-6 cylinders and storage yards, gaseous diffusion plants, $8,000,000;

(3) Project 81-R-503, Utilities upgrading, gaseous diffusion plants, $27,000,000;

(4) Project 81-R-504, Supervisory control and data acquisition systems, Paducah, Kentucky and Portsmouth, Ohio gaseous diffusion plants, $13,000,000;

(5) Project 81-R-505, Instrumentation for purge cascades and withdrawal areas, gaseous diffusion plants, $6,000,000;

(6) Project 81-R-506, Environmental protection and safety modifications, Phase I, gaseous diffusion plants, $55,000,000;

(7) Project 80-UE-1, Control of gaseous diffusion effluents, gaseous diffusion plants, Oak Ridge, Tennessee and Paducah, Kentucky, an additional sum of $4,700,000, for a total project authorization of $7,000,000;

(8) Project 80-UE-2, Control of water pollution, gaseous diffusion plants, an additional sum of $9,500,000, for a total project authorization of $17,000,000;

(9) Project 80-UE-3, Plant facilities security improvements, gaseous diffusion plants, an additional sum of $12,500,000, for a total project authorization of $17,000,000;

(10) Project 80-UE-4, Power recovery demonstration cells, gaseous diffusion plants, an additional sum of $7,000,000, for a total project authorization of $10,500,000;

(11) Project 80-UE-5, Motor and switchgear upgrading, gaseous diffusion plants, an additional sum of $20,600,000, for a total project authorization of $28,500,000; and

(12) Uranium Enrichment activities capital equipment not related to construction, $24,000,000.

SEC. 703. (a) Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for operating expenses for Departmental Administrative activities programs as follows:

(A) Policy Analysis and Systems Studies, $19,600,000;
(B) International Affairs, $5,100,000;
(C) Management and Support, $287,635,000;
(D) Intergovernmental and Institutional Relations, $36,743,000;
(E) In-House Energy Management, $3,900,000;

(F) Security Investigations, $17,012,000; and

(G) Other supporting activities, cost of work for others, and changes in inventories, $55,803,000.

(b) Funds are hereby authorized to be appropriated for fiscal year 1981 in accordance with section 660 of the Department of Energy Organization Act for Departmental administrative activities plant and capital equipment, including planning, construction, acquisition, or modification of facilities, including land acquisition; and acquisition and fabrication of capital equipment not related to construction, as follows:

(A) Project 81–A–601, Modifications for energy management, various locations, $28,200,000;

(B) Project 81–C–601, Plant engineering and design, $9,000,000;

(C) Project 81–A–602, Energy monitoring and control system, Y–12 plant, Oak Ridge, Tennessee, $5,000,000;

(D) Project 81–A–603, Energy monitoring and control system, Oak Ridge National Laboratory, Tennessee, $4,000,000;

(E) Project 81–A–604, HVAC heat recovery and night setback, Richland, Washington, $3,000,000;

(F) Project 81–A–605, Automated energy management system, Argonne National Laboratory, Illinois, $3,800,000;

(G) Project 80–DA–6, Alternate energy source, Pantex plant, Texas, an additional sum of $43,300,000, for a total project authorization of $46,600,000; and

(H) Departmental administration capital equipment not related to construction, $5,165,000.

TITLE VIII—AUTHORIZATION OF APPROPRIATIONS FOR FISCAL YEAR 1982

SEC. 801. There is authorized to be appropriated to the Department of Energy to be available no earlier than October 1, 1981, such sums as may be necessary for fiscal year 1982 for programs set forth in this Act.

FY 1981 DOE AUTHORIZATION BILL FOR CIVILIAN APPLICATIONS—SECTION-BY-SECTION ANALYSIS

TITLES I–VII

Secs. 101 through 703. These sections comprise the first seven titles of the bill. They authorize the appropriations necessary to support the Department's civilian activities during fiscal year 1981. The respective titles are: I—Research and Development; II—Commercialization and Related Activities; III—Regulatory and Related Functions; IV—Power Marketing and Federal Leasing; V—Nuclear Assessment, Spent Nuclear Fuel Storage and Commercial Waste Remedial Action; VI—Other Fossil Energy, Solar Energy and Conservation Activities; and VII—Other Departmental Activities. These portions of the bill meet the requirements of section 660 of the Department of Energy Organization Act calling for annual authorization for appropriations for Departmental activities. Detailed justifications of the amounts to be authorized are contained in the Department of Energy FY 1981 Budget Justifications.

TITLE VIII

Section 607 of the Congressional Budget and Impoundment Control Act of 1974, Public Law No. 93–344, states that ". . . any request for the enactment of legislation authorizing the enactment of new budget authority to continue a program or activity for a fiscal year . . . shall be submitted to the Congress not later than May 14 of the year preceding the year in which such fiscal year begins. . . ." Accordingly, section 801 requests authorization of appropriations for FY 1982.

SECTION-BY-SECTION ANALYSIS

TITLES I–VII

Secs. 101 through 703

These sections comprise the first seven titles of the bill. They authorize the appropriations necessary to support the Department's civilian activities during fiscal year 1981. The respective titles are: I—Research and Development; II—Commercialization and Related Activities; III—Regulatory and Related Functions; IV—Power Marketing and Leasing; V—Nuclear Assessment, Spent Nuclear Fuel Storage and Commercial Waste Remedial Action; VI—Other Fossil Energy, Solar Energy and Conservation Activities; and VII—Other Departmental Activities. These portions of the bill meet the requirements of section 660 of the Department of Energy Organization Act calling for annual authorization for appropriations for Departmental activities. Detailed justifications of the amounts to be authorized are contained in the Department of Energy FY 1981 Budget Justifications.

TITLE VIII

Section 607 of the Congressional Budget and Impoundment Control Act of 1974, Public Law No. 93–344, states that ". . . any request for the enactment of legislation authorizing the enactment of new budget authority to continue a program or activity for a fiscal year . . . shall be submitted to the Congress not later than May 15 of the year preceding the year in which such fiscal year begins . . ." Accordingly, section 801 requests authorization of appropriations for FY 1982.

XIII. ADDITIONAL AND DISSENTING VIEWS

ADDITIONAL VIEWS BY REPRESENTATIVE GEORGE E. BROWN, JR. ON THE FY 1981 DEPARTMENT OF ENERGY AUTHORIZATION ACT

Once again, the Science and Technology Committee has approved DOE authorization legislation that has little chance of enactment. While the key issue at hand is the continuing futile fight over the Clinch River Breeder Reactor Project, which past Committee reports cover in depth, there are a number of other issues in this bill which concern me.

My main concern is that the disorganization in the Administration's energy policy and programs is exceeded, and indeed exacerbated, by the actions and inactions of the Congress. This Committee in its actions on the authorization bill, rather than setting an example for other Committees of the Congress (which actually have an overall poorer record in careful legislation), has now succumbed to the temptation to act as if no other Committee or constraints existed upon the actions of the Committee. Nowhere is this more true than in the nuclear energy related aspects of this reported bill. Not only is there more than a $300,000,000 difference between the Administration's nuclear energy budget and the Committee's, of which approximately $260,000,000 is for the Clinch River Breeder Reactor Project and related breeder research and development work not requested by the Admintration, but there is legislative and report language that contradicts policies and programs established by the Administration and other Committees of the Congress. Regardless, of what one thinks about the nuclear non-proliferation policies, or the recommendations of the Administration's Interagency Review Group on Radioactive Waste Management, it is clear that other points of view than this Committee's are widely held in the Congress. Unless sincere efforts are made to reconcile such differences in the Congress, and between this Committee and the Administration, a stalemate is likely to develop. I believe the approach in this bill jeopardizes the credibility of the Science and Technology Committee, leads to unnecessary disputes, and last, but not least, undermines the chances of developing a responsible nuclear future.

My other concerns center on the inadequate attention given by the Congress and the Administration as a whole to energy conservation activities. The program for energy education, energy outreach, research and development of energy efficient technologies, and the effective implementation of all these efforts should be a matter of concern to all. Unfortunately, energy efficiency and energy conservation have again taken last place on the agenda. In the House, Committee mark-up of the Administration's energy conservation initiative, the

Energy Management Partnership Act, has been indefinitely postponed. As this indecision on new programs continues, older, but proven effective programs, like the National Energy Extension Service Act, languish in an administrative and legislative limbo. We can all pass the blame or share the blame for this state of affairs. It would be preferable, however, that we should all swallow some pride, compromise some views, and resolve to get on with solutions to some of our energy problems.

George E. Brown, Jr.

ADDITIONAL VIEWS OF JOHN W. WYDLER ON BUDGETARY ISSUES

The budgetary situation we are presented with is a most difficult one and goes beyond this DOE Authorization Bill. The House Budget Committee reduced the Energy Function No. 270 by $500 million in budget authority (appropriations requirements) for FY81. In view of the unsatisfactory nature of the request for nuclear programs, this recommendation aggravated an already serious funding problem. This was further complicated by the potential competition of add-ons for conservation and solar programs. By this latter action, this Committee has effectively deferred to the Appropriations Committee to set program priorities in solar and conservation rather than the authorizing committee.

We must also be aware of the potential budgetary impact of the various Titles of the Synthetic Fuels Bill, S. 932. I am a Conferee on that Bill and although the authorization levels have been reduced from the Senate Bill, there are still many new programs which will require appropriations competing in the same energy Budget Function No. 270. Among these are the conservation and solar banks which are to be authorized at $300 million from FY81 even though the Administration's amended request reduced this figure to $47.5 million. The incentive for gasohol and energy from other biomass sources will have additional impacts not yet estimated by the Congressional Budget Office. In view of these competing budgetary pressures, and the need to retain the prerogatives of an authorization committee, I am very concerned about the total authorization figure of the Committee. However, I do feel that many of the programs authorized at near level funding or retained by the Committee are the most vital energy supply programs in the federal government.

I think it is important to realize that the two principal energy subcommittees were presented with quite different budget requests for FY81. The Energy Research & Production Subcommittee was given a budget in which at least four major nuclear programs were zeroed by the Administration. In retaining these programs to reasonable levels the Subcommittee made cuts of over $400 Million in other programs to keep the overall level down. These cuts came principally in Uranium Enrichment, Basic Energy Sciences, General Science and Geothermal programs. The EDA Subcommittee on the other hand, was presented a budget which provided real growth in solar, conservation and fossil programs. In fossil energy, the EDA Subcommittee actions were reasonable and funds were cut back to real appropriations needs. However, in solar and conservation the EDA add-ons (supported in full Committee against a series of Minority amendments) resulted in growth from FY80 of 24 percent in solar and an astounding 44 percent in conservation. These funding enhancements are not appropriate in the present budget climate and do not serve the best interests of the Science Committee in exercising its authorization responsibility.

This authorization legislation cannot be considered in the vacuum of program advocacy. It is desirable that programs have particular champions but huge add-ons for these activities in this budgetary climate cannot be credible with the Appropriations Committee or the Budget Committee.

John W. Wydler.

DISSENTING VIEW OF CONGRESSMAN HOWARD WOLPE ON THE CLINCH RIVER BREEDER REACTOR

The issue of funding for the Clinch River Breeder Reactor has been the topic of considerable debate for a number of years. There is no need to reargue that debate at this time. However, there are a number of factors unique to this year's debate and worthy of mention.

First of all, it is clear that we will once again muddle along without an authorization bill for the Department of Energy if funding is included for the Clinch River Breeder Reactor. The energy problems which confront our nation are too serious to allow the efforts of this committee to again come to naught because of the Clinch River issue.

Secondly, in light of the current mood of fiscal austerity, it is imperative that we closely examine every federal expenditure. The Clinch River project simply does not withstand close economic examination. Recent decline in the rate of electrical growth indicates that the nation's supply of uranium for conventional light water reactors will extend much further into the future than initially anticipated. Thus, the need for the commercialization of breeder technology has been pushed so far into the future as to make the development of a demonstration commercial breeder clearly premature and totally unjustified from a cost-effective standpoint.

Third, from a scientific and engineering standpoint, the specific design for the Clinch River Breeder Reactor is already obsolete and of little utility. Even one of the strongest proponents of the development of breeder technology, Dr. Hans Bethe, a Noble Prize winning nuclear physicist, asserts that the design of the Clinch River Breeder Reactor is in fact obsolete. To quote Dr. Bethe:

"That breeder does not need to be the Clinch River breeder. In fact, the Clinch River breeder is rather obsolete. Such a long time has elapsed since the design of that reactor and the building so that we probably would be better off to start from the beginning and have a new design for the breeder."

In this connection, it should be noted that my effort in the Committee to delete funding for the Clinch River project was not intended as an attempt to cut funding for breeder research and development in general. In fact, my amendment to delete funding for the Clinch River project also included language to restore funding for Admiral Rickover's successful thorium breeder program.

HOWARD WOLPE.

DISSENTING VIEWS OF HON. JOHN W. WYDLER; HON. LARRY WINN, JR.; HON. BARRY M. GOLDWATER, JR.; HON. HAMILTON FISH, JR.; MANUEL LUJAN, JR.; HAROLD C. HOLLENBECK; HON. ROBERT K. DORNAN; HON. ROBERT S. WALKER; HON. EDWIN B. FORSYTHE; HON. WILLIAM CARNEY; HON. ROBERT W. DAVIS; HON. TOBY ROTH; HON. DONALD LAWRENCE RITTER; and, HON. BILL ROYER REGARDING THE SOLAR ENERGY RESEARCH INSTITUTE (SERI) FACILITY

In both fiscal year 1979 and fiscal year 1980, the U.S. Department of Energy advised this Committee that they required a total of $30,000,000 to build a 200,000 square foot facility in Golden, Colorado for the Solar Energy Research Institute (SERI). In neither year did the Department of Energy (DOE) provide to the Committee justification for the project. There was no claim that present quarters are unsafe, nor that present quarters are inefficient to the point that SERI personnel could not work, nor that present facilities would not allow SERI personnel to administer programs for which they are responsible. As recently as April 10, 1980, the SERI Director, Dennis Hayes, was quoted in the Engineering News Record to the effect that, even if there are delays in constructing the requested facilities, these delays will not affect the Solar Research program at SERI.

The Department of Energy did not provide a formal construction request for the SERI facility to this Committee for the fiscal year 1981. Committee staff has been advised, unofficially, that the present concept has more than doubled in size to 460,000 square feet and has tripled in cost to nearly $100,000,000. The staff has also been told that, if the Committee will provide $7,000,000 for design purposes in fiscal year 1981, the DOE will request from the Committee in the fiscal year 1982 approximately $45,000,000. It is quite apparent that the scope of the project is much greater than originally anticipated and will require significant levels of authorization in the next several years. It is quite apparent to us that this project lacks definition and is therefore out of control at this time.

In previous authorizations, such as the COALCON and Powerton Plant contracts, when the Committee was faced with a project which had tripled in price before ground was broken, the projects were cancelled. Such a condition appears to exist in the case of the SERI facility.

It is our belief that all action on this project should stop, except for a holding action, until we have received word from DOE on: (1) the size of the facility; (2) the total cost of the facility; (3) the construction schedule for the facility; and (4) the justification for the facility.

As we know, SERI is a contractor who with the State of Colorado offered in their original proposal to make available an option to DOE to obtain ownership of 300 acres of land. This option was to extend for a period of five years after the contract for the SERI facility was signed. There are no strings attached to this property except that DOE will use the land only for SERI-related activities. Three years have elapsed since the contract execution and it may be timely to exercise the option for the land. In order that SERI activity will continue on schedule, the land coud be used at this time for on-site solar experiments.

We believe that a more deliberate, realistic approach to the use of land in Colorado for SERI and its activities is warranted. The alternative could result in the expenditure of far greater amounts of money than was originally anticipated, or is even presently estimated. The Committee needs far more information than it presently has before it can authorize any additional, substantial amounts of money for this project.

Our support for responsible solar research and technology development remains undiminished. But only through a prudent and proper expenditure of Federal funds can we achieve a balance between our commitments to energy development and fiscal responsibility.

John Wydler.
Larry Winn, Jr.
Barry M. Goldwater, Jr.
Hamilton Fish, Jr.
Manuel Lujan, Jr.
Harold C. Hollenbeck.
Robert K. Dornan.
R. S. Walker.
Edwin B. Forsythe.
Wiliam Carney.
Bob Davis.
Toby Roth.
Don Ritter.
Bill Royer.

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